Maestro™ II

A64-BI

Software Operator's Manual

EG&G ORTEC

Maestro™ *II* Software
Operator's Manual

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

INTRODUCTION

A multichannel analyzer (MCA) is an instrument that records the number of signal pulses occurring at different pulse heights. These numbers are displayed in a graph whose horizontal axis represents the height of the pulse and whose vertical axis represents the number of pulses at that height. For nuclear MCAs, the input signals usually come from a detector and the height of the pulse is proportional to energy.

MAESTRO II combined with a multichannel buffer (MCB) and a personal computer (PC) makes an MCA of remarkable power and flexibility. The MCB provides the fast data collection, the PC provides the display and data storage facilities (e.g., floppy diskettes) and the MAESTRO II software provides the link between the operator, the pulse height data (often called a spectrum) and the hardware. It provides complete control of the MCB, display and storage of the data and analysis of the spectral data.

The MCB is an intelligent data acquisition instrument. It can collect data independently of the PC; that is, the PC can be doing other programs while the MCB is collecting a spectrum. All of the features of the MCB are controlled by MAESTRO II in an easy and straightforward manner. MAESTRO II provides both pull-down menus and hot keys (single keys that perform a function) for use by new and experienced operators.

The PC display continuously shows the spectrum, the current operating conditions and the available menus. Working on the spectrum is the most important and most used function of any MCA display, and MAESTRO provides all of these functions on single-key hot keys. Peak location, ROI insertion, expand/contract, scrolling left/right and vertical scale are all hot keys.

Spectrum peak searching, report generation, printing, archiving, calibration and other analysis tools are available from pull-down menus. When writing files to disk, the operator is warned about duplicate filenames. When reading files from disk, the operator can select from a list of appropriate files on the disk. A buffer is maintained in the computer memory so that spectra can be collected while another is being analyzed.

FOR THOSE WHO CAN'T WAIT

Copy all the program files (those with extensions of .EXE) to C:\MCA and run the M2SETUP program to define the MCB type. Now run MCA to display the spectrum. The list of pull-down menus is shown near the top of the screen. The menus are pulled down by pressing the Alt key (<Alt>) and the underlined character in the menu name (e.g., <Alt A> in Acquire). The menu commands are selected by pressing the Alt key (<Alt>) and the underlined character in the menu option list. The cursor keys also move around in the menus. The <F1> displays the help screen for the display hot keys.

WHEN ALL ELSE FAILS

The remainder of this manual contains loading and set up instructions for installing MAESTRO II for any combination of MCB hardware, changing the screen colors, the purpose of and how to use supporting programs, a self-teaching section that guides you through the features of MAESTRO II, the reference sections for keyboard operation and command file operation, how to use MAESTRO II files in programs you write yourself, and how to write automatic job streams for unattended operations.

HARDWARE

MAESTRO II will run on any IBM PC, IBM PS/2 or compatible computer. It uses either the EGA or VGA display adapters. The printed reports use the PRN or LPT1 parallel adapter. The math co-processor will be used if installed, but one is not needed. Data can be saved or retrieved from any number of floppy or fixed disk drives.

SYSTEM INSTALLATION

PROGRAMS

The MAESTRO II emulation software consists of many separate programs that perform distinct functions. This separation makes the operation of the basic emulation software easier and is well suited for job streams or batch processing of data.

The programs are the following:

MCA.EXE

This is the main program of MAESTRO II. It is the MCA emulation software and can display data, print reports and control the MCB hardware.

M2COLORS.EXE

This program allows the operator to select the colors used in the MCA program. Any color combinations of the 64 colors available can be selected for the different sets of data on the display.

M2SETUP.EXE

This program creates a disk file that contains the MCB hardware definition (i.e., MCB type and memory size). The disk file is used by MCA to define the display and control commands.

MCASER.EXE

This is the main program of the serial-only communications version of MAESTRO II. It is like MCA.EXE emulation software except all MCB dialog is via the RS232 serial line.

PLOT.EXE

This program plots an MCA spectrum file on an HP 7470A plotter.

GRAF350.COM

This program produces a plot of the MCA screen display on an IBM graphics printer. It uses <PrtSc> (which is <Print Screen> on new keyboards).

PARSE.EXE

This program checks the command files for validity and produces a compiled version of the command file for use by the MCA program.

MAKELIB.EXE

This program converts a library text file into the form used by the MCA.

LOADING ON FLOPPY DISK

MAESTRO II can be operated from floppy disk. It can be run from the DOS diskette (as in a one diskette system) or from a separate diskette. The MAESTRO diskette can be removed while it is running so that data can be stored on another diskette, but it should be replaced before exiting so that the current calibration can be saved in the file CONFIG.M2.

The minimum requirement is to copy the MCA.EXE file to the running diskette. This will use the default configuration and colors.

To select the correct hardware configuration, the M2SETUP must be run. Copy M2SETUP.EXE to the running diskette first; run M2SETUP to describe the hardware and to create the CONFIG.M2 file on the diskette. Now delete M2SETUP from the diskette and copy MCA.EXE to the running diskette. Running MCA from this diskette (as the default diskette) will now use the set up selected.

The other programs can be loaded on the MCA diskette (depending on the diskette capacity) or on other diskettes. PARSE and MAKELIB use text files as input, so they should be loaded on a diskette containing a text editor. The results of PARSE should then be copied to the running diskette.

LOADING ON FIXED DISK

All of these programs can be loaded on the hard disk. Any programs that will not be used (e.g., the PLOT program) do not need to be loaded. Use the DOS function to create the C:\MCA subdirectory and copy all of the programs from the distribution diskettes to this subdirectory. Put this subdirectory in the PATH (see DOS) so that the programs can be executed from any subdirectory. DOS will operate faster when the disk files are distributed over several directories and it is more convenient to separate spectrum files according to the type of sample.

The following sequence will load the files on the fixed disk:

```
C > MD C:\MCA
C > CD C:\MCA
C > COPY A:*.EXE
C > COPY A:*.COM
C > MD C:\USER
C > CD C:\USER
C > COPY A:*.CHN
```

Depending on the type of diskette, the necessary files may be on more than one diskette.

1. Run M2SETUP to define the MCB hardware connected to the PC.

2. Run M2COLORS, if desired, to define the colors MAESTRO II will use in the display.

3. Run GRAF350 to enable hard copy of the display screens on a graphics printer.

MCA or any of the other programs may now be run.

The serial-only version (MCASER) can communicate with any of the standalone (i.e., not plugged into the PC motherboard) MCBs. The MCBs are connected to the computer's communication adapter with an RS-232 cable. If multiple MCBs are connected, a communications switch must be used. The M2SETUP program is used to define the type of MCB and, if multiple MCBs, which port of the switch is used for each MCB. The MCBs should be set to 9600 baud, 8 data bits, even parity, and 2 stop bits.

Notes

WALK THROUGH

FIRST-TIME WALK THROUGH

This section, which demonstrates the emulation software, is written to help the novice with the basics of operation and provide some insight into the capabilities of the advanced functions. Experienced users may want to skip Basic Functions and go directly to the Advanced Features section or the section on 919 or 92X features.

After loading the emulation programs, load the files necessary for the Walk Through from the auxiliary programs diskette. The following files should be loaded into your directory on the hard drive:

Copy this	To this
LIB.MCB	LIB.MCB
8H4275.CHN	DEMO.CHN
DEMO.TXT	DEMO.TXT
DEMO.CMD	DEMO.CMD

Multikey functions, such as <Alt 1>, are executed by holding down the Alt key while pressing a number key on the top row of the keyboard. Some functions, such as <Alt R>, have different meanings depending on the menu displayed. These different functions are labeled by the menu select key; e.g., <Alt F>, <Alt R> for recall a file.

Before starting MAESTRO II, run the M2SETUP program to create the CONFIG.M2 file so that MAESTRO II will know what type of MCB is included in the system.

MAESTRO II operates by using pull-down menus to display functions that the operator can perform. The menus are not displayed until requested. The list of menus is shown near the top of the screen. The first character of the name of each menu is underlined. By pressing <Alt> and the underlined character, the selected menu is shown. The menu options can be selected using the <up arrow> or <down arrow> then <Enter> or by pressing <Alt> and the underlined character in the option desired. Usually the first or last character in the option is underlined.

Basic Functions

To start the emulation program, type "MCA" <Enter>. The MCA spectrum from the MCB hardware appears on the screen.

If you press the wrong key for what you want, just press <Esc> to return to the previous display.

When the program starts, the data may all be zeros in the 916, 917 or 918A. In the 919 and 92X, with the battery-maintained memory, the last spectrum stored will be displayed. The spectrum status (on the right side of the display) indicates that the data in the MCB is on the screen by showing MCB in reverse video.

Note that realtime, livetime and deadtime are all displayed for this spectrum (may all be zeros).

Find the menu line (second down from the top) which is showing the available drop-down menus. To select one of the menus, hold down <Alt> while pressing the underlined letter in the menu name.

Press <Alt A> (hold down <Alt> and press and release <A>) to pull down the Acquire menu. The Acquire menu drops down below the word Acquire in the menu line. Use <down arrow> to select start acquisition and <Enter> to start data collection in the MCB. Note the incrementing of the livetime and realtime in the spectrum status section of the display. If a signal is connected, data visibly grows on the display.

Press <Alt A> followed by <Alt P> to stop and then <Alt A> and <Alt C> to clear the MCB. This is faster with the hot keys (<Alt 2> and <Alt 3>). Note the elapsed livetime and realtime are set to 0.

Press <Alt P> to switch to the Preset menu. The spectrum will be redrawn when the menu is cleared.

Press <Alt R> or use <up arrow> and <down arrow> and <Enter> to select a realtime preset. The prompt for the value appears. Type the number "30" (30 seconds), followed by <Enter>. The new preset (30 seconds realtime) is displayed in the preset window near the center of the right side of the screen. The preset menu also disappears.

Press <Alt 1> to start the acquisition. After 30 seconds the acquisition stops automatically.

Press <Alt A> and then <Alt B> to select the Buffer. The Buffer is part of the IBM PC memory which holds a static spectrum. The spectrum is placed there from a disk (via the Files option) or from the memory of the MCB (via <Alt 5>).

The spectrum DEMO.CHN has been supplied for Walk Through purposes. Press <Alt F> to select to the Files menu, which drops down from the Main menu.

Press <Alt R> on the Files menu to recall a spectrum. A list of the CHN spectrum files on the disk is displayed. Use <up arrow> to select DEMO.CHN and <Enter> to load it into the Buffer. The spectrum DEMO appears on the display and the name is shown on the top line of the screen (next to the MAESTRO II name). The horizontal width of the display automatically changes to the size of the spectrum loaded.

Press <Alt 6> to show the spectrum in the MCB. (The spectrum in the PC Buffer can be different from the one in the MCB.) Press <Alt 6> to return to the PC Buffer. The marker now shows the position in channels and keV since the spectral file carries the calibration information. The time window shows the realtime and livetime corresponding to the spectrum DEMO.CHN.

The system is in FULL display. Press <Alt D> then <Alt F> to get the EXPANDED display.

Manipulate the FULL and EXPANDED views with <up arrow>, <down arrow>, <left arrow>, <right arrow>, <Pg Up>, <Pg Dn>, <Home>, <End>, <keypad ->, and <keypad +>.

The position of the window (the region defined by the three markers) in FULL display defines the boundaries of the EXPANDED display. Note that the marker moves more quickly in FULL mode than it does in EXPANDED mode. Press <Pg Up> or <Pg Dn> to increase the speed of the scrolling.

As an exercise, position the marker on the peak in channel 5630. Expand (<keypad +>) the display to 256 channels for horizontal full scale and log vertical scale. The horizontal scale indicator is in the lower right corner of the display and the vertical is just above the middle on the right side.

Press <Alt R> and <Alt M> to set a region-of-interest (ROI), and slowly scroll the marker to set the ROI bits so that the peak is enclosed. Note that the status of the ROI function is shown on the right of the display.

The ROI bits are not set in fast cursor-movement mode; e.g., <Pg Up>. The ROI is shown by changing the spectrum to red dots. When the regions cover channels 5608 to 5656, press <Alt R> and <Alt O> to return the ROI Set mode to "Off". All the ROIs can be removed by pressing <Alt R> and <Alt C>. Individual ROIs are removed by <Alt R> then <Alt U> and then moving the marker <left arrow> or <right arrow>.

NOTE: Include at least three channels of the background above and below the peak to increase the accuracy in computing the net areas.

Place the marker in the ROI. Press <Alt C> then <Alt A> (Peak Area) to display the Net and Gross areas.

Press <Alt C> then <Alt I> (Peak Info) to display peak shape parameters.

Press <Alt C> then <Alt F> (FWXM) and type "100" followed by <Enter>. The FW.01M is then calculated and shown at the bottom.

Press <Alt F> then <Alt T> (ReporT). Check to see that the printer is connected and ready. Type "PRN" followed by <Enter>. An analysis report is printed for the defined ROI.

Press <Alt R> to select the ROI menu. Press <Alt S> to save the defined ROI to a disk. Name the disk file "DEMO".

Recall the spectrum DEMO once more from disk. (Press <Alt F> then <Alt R> and select DEMO.) The ROI previously set has been lost. Press <Alt R> then <Alt R> and select filename DEMO to restore it. The ROI data can be restored to the Buffer or to the MCB.

Move the marker to the ROI by pressing <Home> then <shift right arrow>. Put the display in EXPANDED mode with <Alt 4>. Press <Alt F> then <Alt P> to print the displayed ROI channel data.

NOTE: If the marker is not in an ROI, all of the displayed channel data is printed, which in FULL display means that 8000 channels could be printed. Use <Escape> to stop the printing. The printout stops at the end of a line.

Calibration

So far, the Walk Through has operated on a precalibated spectrum. In order to demonstrate the calibration procedure, the spectrum must be recalibrated as though it were newly acquired in the Buffer.

Press <Alt 6> to display the Buffer. Move the marker to below the peak at channel 538. Press <Alt R> then <Alt B> to define the beginning of the ROI. Use <Pg Up> to move the marker to above the peak. Note that the ROI bits have not been set and that the ROI status is BEGIN. Press <Alt R> and <Alt E> to set the ROI between the ends. Two peaks are needed for calibration. So now move the marker to below the peak at channel 5631. Press <Alt R> then <Alt B> to define the beginning of the ROI. Use <Pg Up> to move the marker to above the peak. Press <Alt R> and <Alt E> to set the ROI between the ends.

Press <Home> then <shift right arrow> to position the marker on the lower ROI. Press <Alt C> then <Alt C> (Calibrate) and type 123.1. (This is the energy of the lower peak in keV.) Press <shift right arrow> to go to the upper ROI and repeat this procedure, typing 1274.4 for the energy. Now enter the units as keV. The system is now calibrated and the cursor reads in keV. If the spectrum is saved to disk, the calibration will be saved with the spectrum.

To save the spectrum to a disk with the name DEMO2, press <Alt F> to go to the Files menu. Press <Alt S> to save the spectrum. Type "DEMO2" for the filename. Now type the sample description. This will be saved with the spectrum on the disk.

This concludes the Basic Features Walk Through. To stop the MAESTRO II, press <Alt S> then <Alt Q> and type "Y" <Enter>.

ADVANCED FEATURES WALK THROUGH

If continuing from the Basic Walk Through, the DEMO spectrum will be in the Buffer and you can continue, otherwise load the DEMO spectrum from disk using the process explained above.

Smoothing

Display the buffer in EXPANDED mode in order to see the effect of the smoothing operation. Press <Alt 4> to expand the spectrum.

Press <Alt C> then <Alt H> (SmootH) to smooth the spectrum. After a few seconds a slight rearrangement of the data occurs as the smoothing calculation passes the field of view.

Stripping

Press <Alt C> to pull down the Calculate menu and <Alt P> to select the Strip operation.

Now you must enter the factor used to scale the disk spectrum up or down before the subtraction is done. If 0 is entered then the factor used is the ratio of the livetimes of the two spectra. If a -1 is entered then the two spectra are added. The livetime and realtime are not changed.

Comparing Two Spectra

Expand the spectrum (using <Alt 4>) and press <Alt F> then <Alt C> to select the Compare option. To compare the stripped spectrum in the MCB Buffer with the original spectrum, type the filename "DEMO".

Move the spectrum up and down using <shift up arrow> and <shift down arrow> on the right side of the keyboard. Use <Esc> to exit the Compare mode.

Rapid Menu Selection

If you select the wrong pull-down menu, a convenient way to move from menu to menu is to use the <left arrow> and <right arrow>. Note that the display will switch from MCB to Buffer as we pass from a function that requires the MCB to one that requires the Buffer. No change occurs if the menu will operate on either the MCB or the Buffer.

Advanced Cursor Movements

The cursor can be controlled using the following keys on the numeric keypad: <right arrow>, <left arrow>, <Home>, <End>, <shift right arrow>, <shift left arrow>, <Ctrl right arrow>, <Ctrl left arrow>, <Pg Up>, and <Pg Dn>. On the enhanced keyboard either of the duplicated keys will work.

If not displaying the Buffer, press <Alt 6> to switch the display to the Buffer. Press <Alt F> then <Alt R> to recall a spectrum. Use <down arrow> then <Enter> to recall the spectrum DEMO.

Press <End>. The marker moves to the right side of the spectrum display. Press <Home>. The marker returns to the left side of the spectrum.

ROI Insert and Delete

Use the high speed move (<Pg Up>) to place the marker in channel 512 or nearby, and press <Alt 4> to expand the display. Position the marker at the center of a peak. Press <Ins> to set a ROI. Press <Del> to remove the ROI. Repeat this for several peaks, by moving to the next peak and setting the ROI.

Return the marker to channel 0 using <Home>. Use <shift right arrow> to index to the next higher (in channel number) region-of-interest. The <shift left arrow> does the same only indexes to the next lower region.

Remove all the regions-of-interest using the <Alt R> then <Alt C> (ROI Clear All).

Finding Peaks and Identifying Nuclides

Place the marker at channel zero position. Move the marker up past the beginning of the data and press <Ctrl right arrow>. The message "Best library match (nuclide)" appears in the message window.

Nuclide identification requires the following:

A library, LIB.MCB in the current or default directory on the default drive;

A calibrated system.

Hold down <Ctrl right arrow> to scroll through the peaks and a series of "Best library match".

Now do a "What's that?". Place the marker to the left of a peak and press <Ctrl right arrow>. This will move the marker to the centroid of the peak. Press <Ins> to mark the peak. Next go to the Files menu and select Report to print the data. A report is then printed which gives the nuclide name, centroid, area, calibrated FWHM, FW.1M, and FW.02M. This is a quick and convenient way to get information on the peaks.

Peak Search

To do a complete peak search of the spectrum (i.e., automatically mark all the peaks with the ROI) use <Alt C> then <Alt S>.

Press <Alt F> then <Alt R> (Files, Report) to print the results.

Note: Printing fifty or more peaks takes time.

Use the <Alt C> Sensitivity option to alter the peak search sensitivity. Repeat the peak search. Note that the number of peaks the program finds varies with the sensitivity setting.

For additional information on building and editing libraries, see the auxiliary programs.

DOS

Select the Services menu.

Select the DOS option. At the prompt enter any legal DOS command; e.g. "DIR" followed by <Enter>. The following demonstration files will be listed:

DEMO.CHN
DEMO.ROI
LIB.MCB
DEMO2.CHN
DEMO.TXT
DEMO.CMD

Type "EXIT" <Enter> to return to MAESTRO II.

User Program

Select the Services menu.

The User Program option is designed to run user programs from within the MAESTRO II and then return to the MAESTRO II. Type "MAKELIB" in response to the prompt.

To execute a Batch file, type "Command/C FILENAME", where FILENAME is the name of the Batch file.

CMD Files

Select the Services menu.

The Command File option allows execution of previously defined command files. Type "DEMO" in response to the prompt. The executable command file DEMO.CMD is produced from the text file DEMO.TXT by the program PARSE (see the auxiliary programs).

After DEMO has finished running, DEMO.TXT may be examined. To look at the DEMO.TXT, select DOS (press <Alt S> then <Alt E>). When the DOS prompt appears, enter "TYPE DEMO.TXT". Note that the syntax (i.e., the way the commands are formulated) for the text is not complicated.

See the section on Command Files for details of the emulation commands.

Type "EXIT" <Enter> to return to the MAESTRO II and Main menu. To stop the MAESTRO II, press <Alt S> then <Alt Q> and enter "Y" <Enter>.

This concludes the Advanced Features Walk Through of MAESTRO II.

919 Features

On the Acquire menu are two functions available for the 919 and 92X: Gain stabilization and zero stabilization.

To show these, the MCB must be acquiring data. From this point on, there must be a working germanium detector connected to the input and a source of gamma rays. One gamma should be low in energy and one near the high end of the spectrum. Use the Acquire menu to clear the MCB memory and start the acquisition.

Zero Stabilizer

Use <Alt 4> to expand the display. Use <Pg Up> and <right arrow> to select a peak in the low energy part of the spectrum. Use <Alt A> then <Alt Z> to select zero stabilization. Now use <down arrow> to select INIT and <Enter> to do it. This will set the zero offset to the midpoint of its range

so that the maximum range is available for the control network. The main display will return.

Move the cursor to the low side of the peak selected for zero stabilization. Use <Alt R> then <Alt B> (ROI, Begin) to begin one side of the ROI. Move the marker to the high side of the peak and press <Alt R> then <Alt E> (ROI, End) to mark the peak as an ROI. The peak should be in the middle of the ROI.

Use <left arrow> to move the marker into the ROI. Press <Alt A> then <Alt Z> to select the zero stabilization menu. Select the Peak option with <Enter>. The start and stop channels of the ROI around the peak are now sent to the MCB and will be used to maintain the zero offset to the current value.

Gain Stabilizer

Use <Alt 4> to expand the display. Use <Pg Up> and <right arrow> to select a peak in high energy part of the spectrum. Use <Alt A> then <Alt G> to select gain stabilization. Now use <down arrow> to select INIT and <Enter> to do it. This will set the gain offset to the midpoint of its range so that the maximum range is available for the control network. The main display will return.

Move the cursor to the low side (for this demonstration, make the beginning about 50 channels below the peak) of the peak selected for gain stabilization. Use <Alt R> then <Alt B> (ROI, Begin) to begin one side of the ROI. Move the marker to the high side (again about 50 channels high) of the peak and press <Alt R> then <Alt E> (ROI, End) to mark the peak as an ROI. The peak should be in the middle of the ROI. This region is much larger than normally used, but it is made this wide so that later manual gain changes will still leave the peak in the ROI.

Use <left arrow> to move the marker into the ROI. Press <Alt A> then <Alt G> to select the gain stabilization menu. Select the Peak option with <Enter>. The start and stop channels of the ROI around the peak are now sent to the MCB and will be used to maintain the gain to the current value.

Now we will show the gain stabilization working. Use <Alt 2> to stop the acquisition, <Alt 3> to clear the data. Now adjust the fine gain of the amplifier a small amount so that the peak is not centered in the ROI but is still in the ROI. Use <Alt 1> to start the acquisition and watch the peak being moved back to the center of the ROI as the data are collected. You

can now also adjust the fine gain very slowly to move the peak around in the ROI and watch the gain stabilizer move the peak back to the center of the ROI. The peak position is best seen with low data in the display, so use <Alt 2> then <Alt 3> to clear the data from time to time.

92X Features

On the Services menu is a feature that is only displayed if the MCB under control is a 92X. The 92X has several features that can be controlled by the computer and they are accessed through this menu (and the gain and zero above).

Fine Gain

The <-> and < + > control the fine gain on the 92X. These are the keyboard keys that have the minus and underscore for <-> and the equal and plus for < + >. On most keyboards, these keys are in the upper right of the main body of keys. They can be used in the gain stabilization demonstration above to adjust the gain while collecting data. To see the effect of the fine gain adjust, turn off the gain stabilization by pressing <Alt A> then <Alt G> (Acquire, Gain Stblzr), select "Off" and press <Enter>. To see the fine gain effect, the display needs to be expanded (<Alt 4>) and displaying an active MCB. Now press <Alt -> to move the peak lower and <Alt + > to move the peak higher. To move in larger steps, press <shift Alt -> or <shift Alt + >. These keys are active whenever a 92X-type MCB is being shown in the spectrum display. The MCB type is shown in the message box, whenever the MCB is selected by <Ctrl Fi> (where i is the MCB number).

Automatic Pole Zero

The automatic pole zero feature of the 92X internal amplifier is best demonstrated with an oscilloscope connected to the amplifier output from the rear panel of the 92X. But if none is available, you can observe the change in peak shape in the spectrum.

Use <Alt S> then <Alt L> to select the 92X Control menu. Use <up arrow> and <down arrow> to select the shaping time constant. Select 2 microseconds for the shaping time. Now select Automatic Pole Zero option and <Enter> to do the pole zeroing. Note in the message box that the pole zero is happening and then that it has finished. This has set the amplifier to the correct settings for 2 microsecond shaping time.

We are now going to change the shaping time to 6 microseconds so that the pole zeroing will be wrong. Look at the pulse shape on the oscilloscope and see how much the pulse deviates from the ideal shape. Now select the Pole Zero option and press <Enter> to start the pole zeroing. Watch the oscilloscope display to see the pulse shape change to the ideal shape.

Use <Esc> to exit from the 92X Control menu.

PULL-DOWN MENUS

The MAESTRO II MCA emulation software is started by entering MCA at the DOS prompt. The first MCA display screen is shown in Figure 1. The figures are in black and white, but the actual screen will be in the colors defined in the \MCA\COLORS.M2 file (created by the M2COLORS program).

The disk file \MCA\CONFIG.M2 (created by M2SETUP) is read when the program is started to define the hardware configuration. The CONFIG.M2 file contains the number of MCBs, the memory size of each, and the last calibration data for each MCB and the PC Buffer. When MAESTRO II exits, all this data is saved in the file so when MAESTRO II is restarted all the calibrations are restored. The preset data for each MCB is read from the MCB at start up.

Shown on the screen are the available menus, the source of the spectrum display, the current presets, the counting times and the current time and date, plus the marker channel and contents.

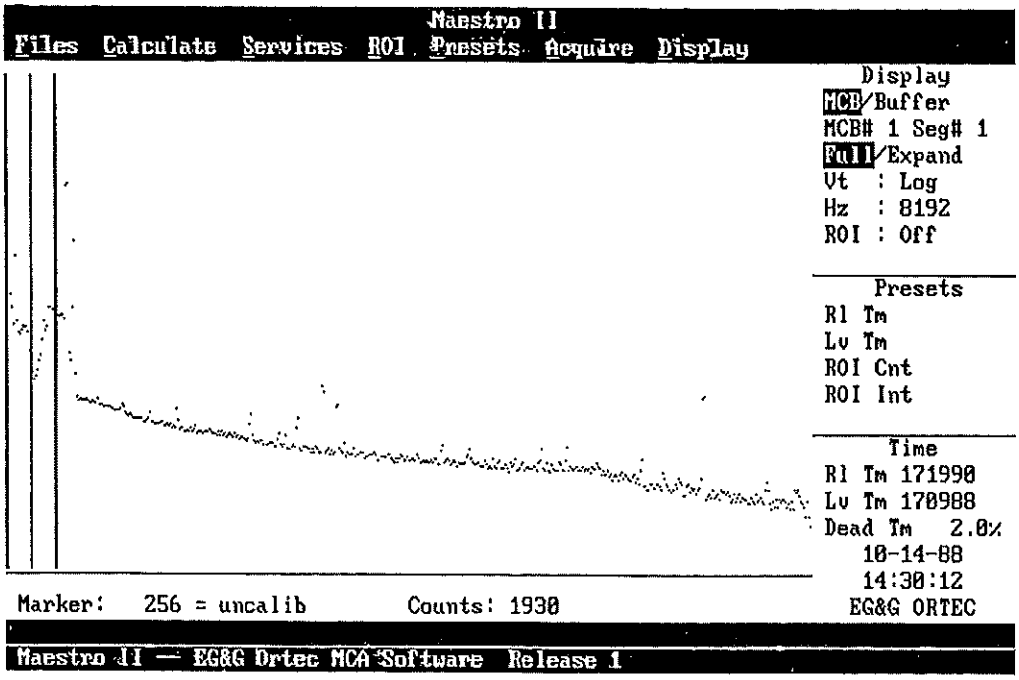


Figure 1. MAESTRO II Start Up

When this screen is displayed, the menus listed above the spectrum display can be selected by using the keys in Table 1,see Figure 2. The spectrum display can be manipulated using the keys in Table 2. The hot keys, for quick access to the most popular functions, are shown in Table 3. Both Table 2 and Table 3 keys are shown in Figure 3. Figure 4 shows details of the plus and minus keys.

Most systems have one detector connected to one MCB. If this system is like that, then the following is not relevant and MCB/Segment means MCB.

One way to expand a system to more detectors is to add more MCBs. MAESTRO II will control up to 8 MCBs. These can be any mixture of 916, 916A, 917, 918A, 919 and 92X types of units. MAESTRO II will correctly display and store a mixture of different sizes of spectra. The MCB numbers start at 1 and go up sequentially to the maximum. The MCB number is shown on the upper right of the status block of the display.

Another way to expand the system is to add a Mixer/Router module such as the 476 to the 917 or 918 MCBs. A system could have multiple MCBs and some of these MCBs could have Mixer/Routers on them. In the MCBs with a Mixer/Router, the MCB memory is divided among the inputs so that each input has an equal share of the MCB memory. These memory sections are called segments. In the segmented MCBs, the conversion gain must be set so that the maximum ADC output address for that segment is inside the memory. The ADC conversion gain must not be larger than the memory allocated to store the data, but it can be smaller.

Throughout this manual reference is made to MCB/Segment. This means that the operation will only use or affect the selected segment of the selected MCB. In the manual mode (where the operator is controlling the operation by pressing keys) with EXPANDED display, the MCB number and segment number are shown on the display. The MCB is selected by <Ctrl i> and the segment is selected by moving the marker to the memory section desired.

The following menus, shown in Figure 2, are on the display when requested:

Acquire

The selections on this menu control the start, stop, clear and data transfer in and out of the MCB. For the 919 and 92X, this also controls the stabilizer.

Display

This menu selects the MCB or the internal Buffer to be displayed on the screen.

Presets

The selections on this menu control the setting and clearing of all the presets in the MCBs.

ROI

The selections on this menu control the setting, clearing and saving of the ROIs for a spectrum.

Calculate

The selections on this menu perform a variety of functions: calibrate the energy scale, peak search, smooth and strip spectra, and display peak area and width.

Files

The selections on this menu control the saving, recalling, and printing of spectra, the printing of reports and the comparing of two spectra.

Services

This menu is the access to command files, DOS functions, and the way to QUIT the program. For the 92X, this also accesses the 92X control menu.

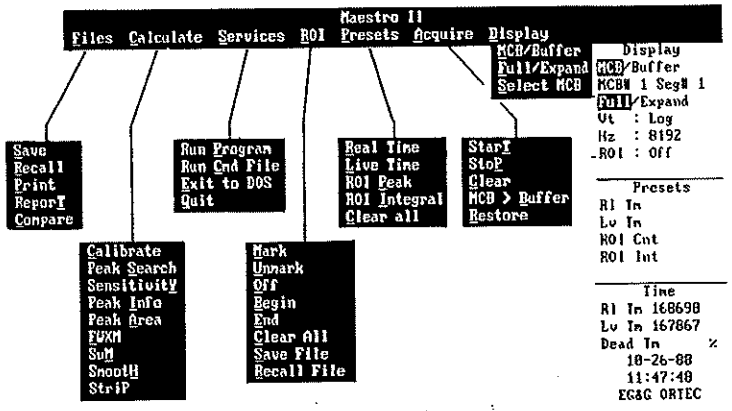
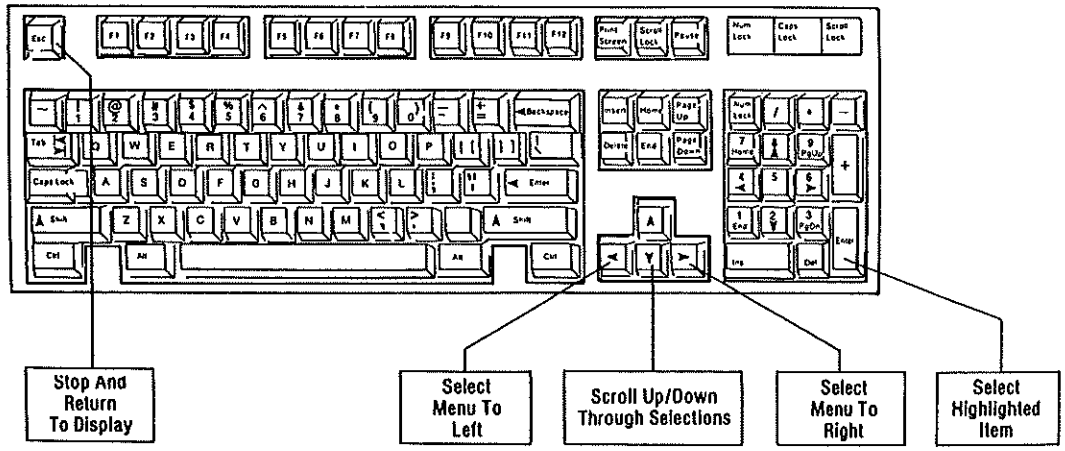


Figure 2. MAESTRO II Pull-Down Menus

When any of the menus are displayed on the screen, the updating of the screen is interrupted and the cursor movement keys are used to select menus and menu items. The <up arrow> and <down arrow> select the menu item to be performed. The selected item is shown in a different color. When the desired menu item is selected, press <Enter> to perform the function. The <left arrow> and <right arrow> move to the menu on the left or right of the displayed menu. In addition, the menu item can be selected by pressing <Alt> and the underlined character in the menu item (<Enter> is not needed in this mode).

Table 1. Main Menu Keys

Key	Function
Alt F	Access Files menu
Alt C	Access Calculate menu
Alt S	Access Services menu
Alt R	Access ROI Operation menu
Alt P	Access Preset menu
Alt A	Access MCB Acquisition Control menu
Alt D	Access Display menu



Menu Mode Keys

MAESTRO II Menu Mode Keys

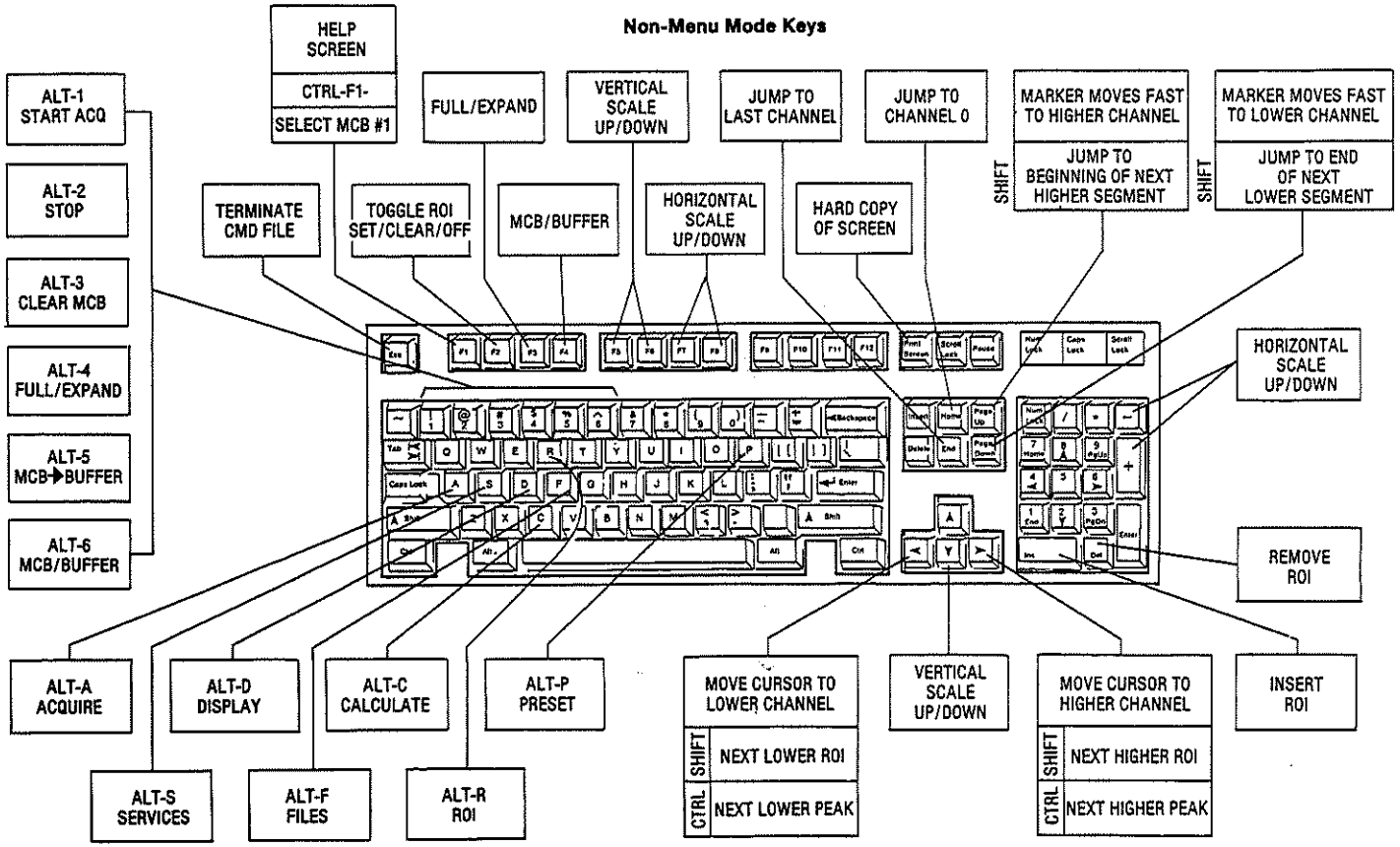


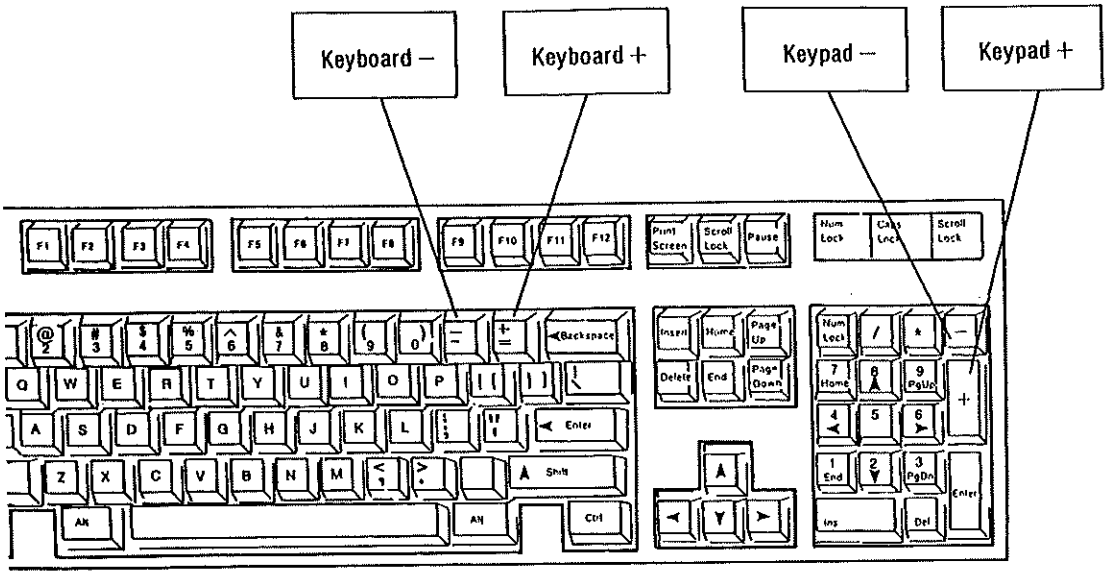
Figure 3. MAESTRO II Keyboards

Table 2. Display Control Keys

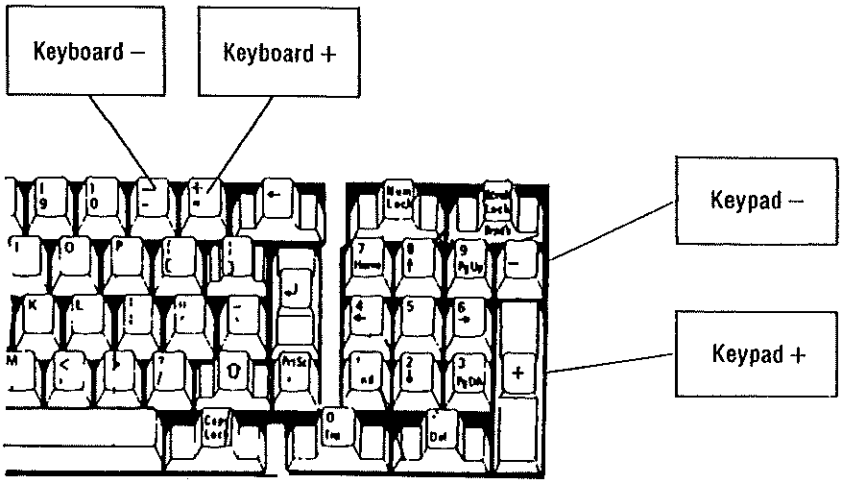
Key	Function
Ctrl F1	Select MCB #1
Ctrl F2,-F8	Select other MCB as configured in M2SETUP
--> (right arrow)	Move cursor to next higher channel number
<-- (left arrow)	Move cursor to next lower channel number
Page Up (Pg Up)	Move cursor to higher channel number in fast mode
Page Down (Pg Dn)	Move cursor to lower channel number in fast mode
Up Arrow	Change vertical scale so that spectrum peaks are larger
Down Arrow	Change vertical scale so that spectrum peaks are smaller
- (keypad minus)	Change horizontal scale so that spectrum peaks are narrower
+ (keypad plus)	Change horizontal scale so that spectrum peaks are wider
Ctrl -->	Jump to next higher channel peak
Ctrl <--	Jump to next lower channel peak
Shift -->	Jump to next higher channel ROI
Shift <--	Jump to next lower channel ROI
Insert (Ins)	Mark the peak region around the cursor as an ROI
Delete (Del)	Clear the ROI for the region with the cursor
Home	Jump to channel 0 for the displayed segment or entire memory if in FULL mode
End	Jump to maximum channel for the displayed segment or entire memory if in FULL mode
Shift Pg Up	Jump to beginning of next segment
Shift Pg Dn	Jump to end of next lower segment

Table 3. Hot Keys

Key	Function
Alt 1	Start acquisition in selected MCB
Alt 2	Stop acquisition in selected MCB
Alt 3	Clear data and collection times in selected MCB
Alt 4	Switch between displaying full memory and expanded display horizontally (channels)
Alt 5	Copy data in the selected MCB to the internal Buffer
Alt 6	Switch between selected MCB and internal Buffer
F1	Display help screen
F2	Switch ROI bit control from OFF to SET to CLEAR
F3	Switch display between FULL and EXPAND modes
F4	Switch display between internal Buffer and MCB device
F5	Same as up arrow
F6	Same as down arrow
F7	Same as keypad minus (-)
F8	Same as keypad plus (+)
Keyboard Alt -	Change amplifier fine gain by smallest increment so that spectrum peaks are lower in channels
Keyboard Shift Alt -	Change amplifier fine gain by ten increments so that spectrum peaks are lower in channels
Keyboard Alt +	Change amplifier fine gain by smallest increments so that spectrum peaks are higher in channels
Keyboard Shift Alt +	Change amplifier fine gain by ten increments so that spectrum peaks are higher in channels



Enhanced Keyboard



Regular Keyboard

Figure 4. MAESTRO II Plus & Minus Keys

Acquire <Alt A>

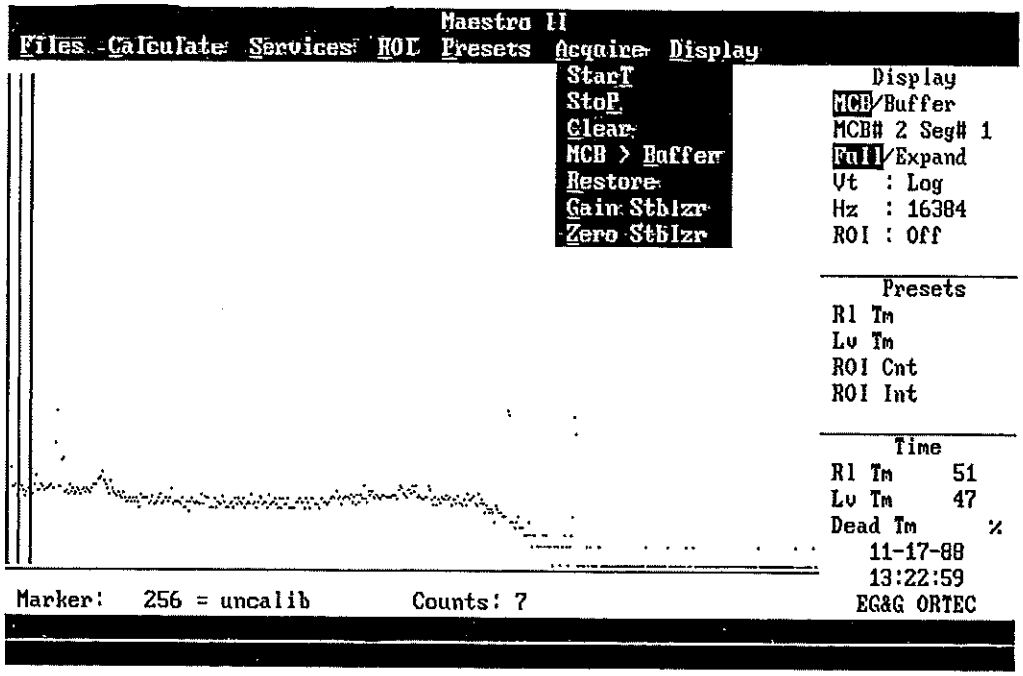


Figure 5. Acquire Menu

The <Alt A> pulls down the Acquire menu. This menu is shown in Figure 5. If the Buffer is on the display, the spectrum display is switched to the selected MCB. The Acquire menu functions are only valid on an MCB/Segment.

One of the most important functions of the MAESTRO II program is to control the collection of the spectrum data in an easy and straightforward way. The acquisition can be controlled by this menu and by single keys (hot keys).

The gain stabilization and zero stabilization options only appear when the active MCB (see upper right of display) is a 919 or 92X MCB.

When this menu is displayed, the screen display is not updated. The menu option keys and the following keys are active. Use the <up arrow> and <down arrow> to select the menu item and <Enter> to perform the action. The <left arrow> moves to the Preset menu and the <right arrow> moves to the Display menu. The <Esc> clears the menu without any action, redraws

the spectrum display and returns to the monitoring mode. If no menu item is selected, <Enter> returns with no action.

Acquire <Alt A>

START <Alt T>

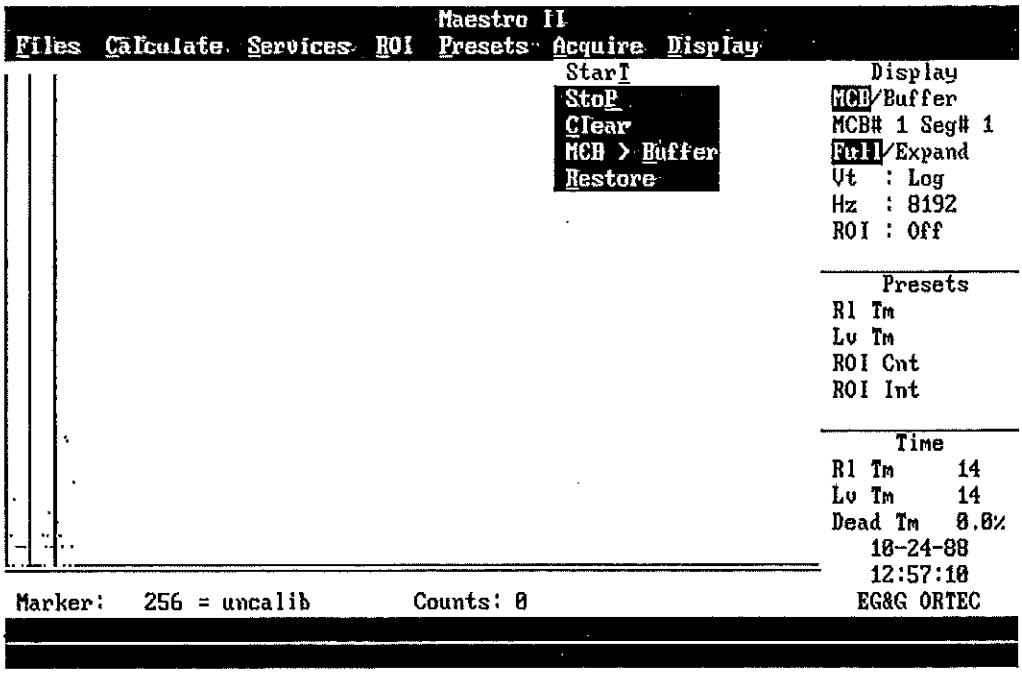


Figure 6. START Acquire

This command starts data collection in the selected MCB. The display must be in MCB mode (see Display). If the MCB is segmented and the display is in FULL mode, all the segments are started (see Display). If in EXPANDED mode, only the segment displayed is started.

If the MCB has already been started, no operation occurs and a message may be printed on the bottom line depending on the MCB type.

See the Preset section for information about the use of presets to stop the acquisition.

The MCB can also be started by <Alt 1>.

Acquire <Alt A>

STOP <Alt P>

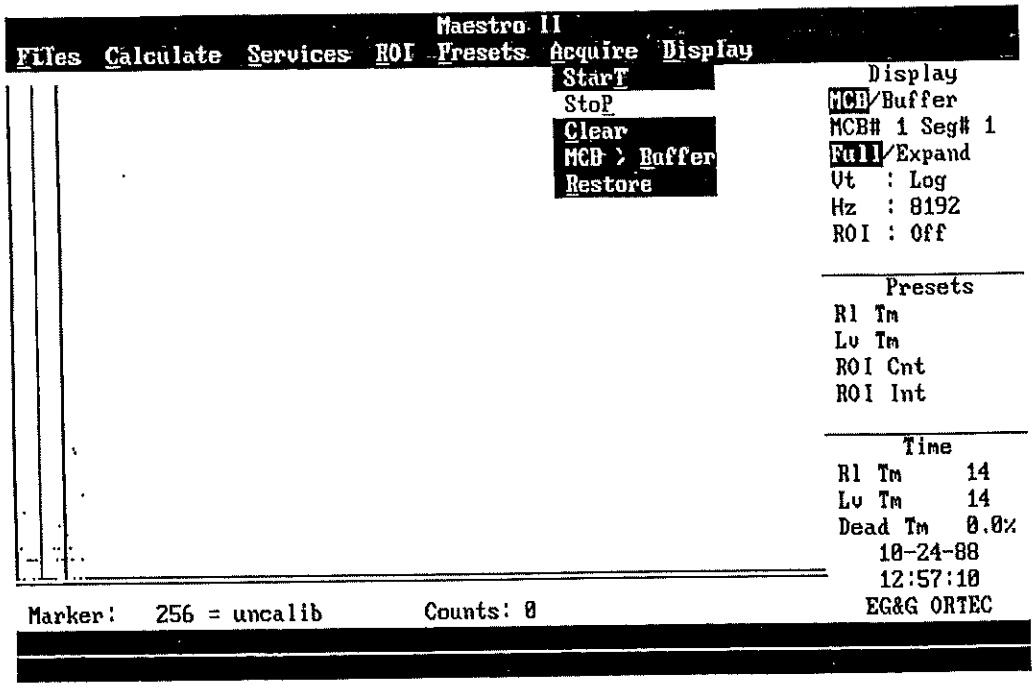


Figure 7. STOP Acquire

This command stops data collection in the selected MCB. The display must be in MCB mode (see Display). If the MCB is segmented, and the display is in FULL mode, all the segments are stopped (see Display). If in EXPANDED mode, only the segment displayed is stopped.

If the MCB is not active, no operation occurs.

The MCB can also be stopped by <Alt 2>.

Acquire <Alt A>

CLEAR <Alt C>

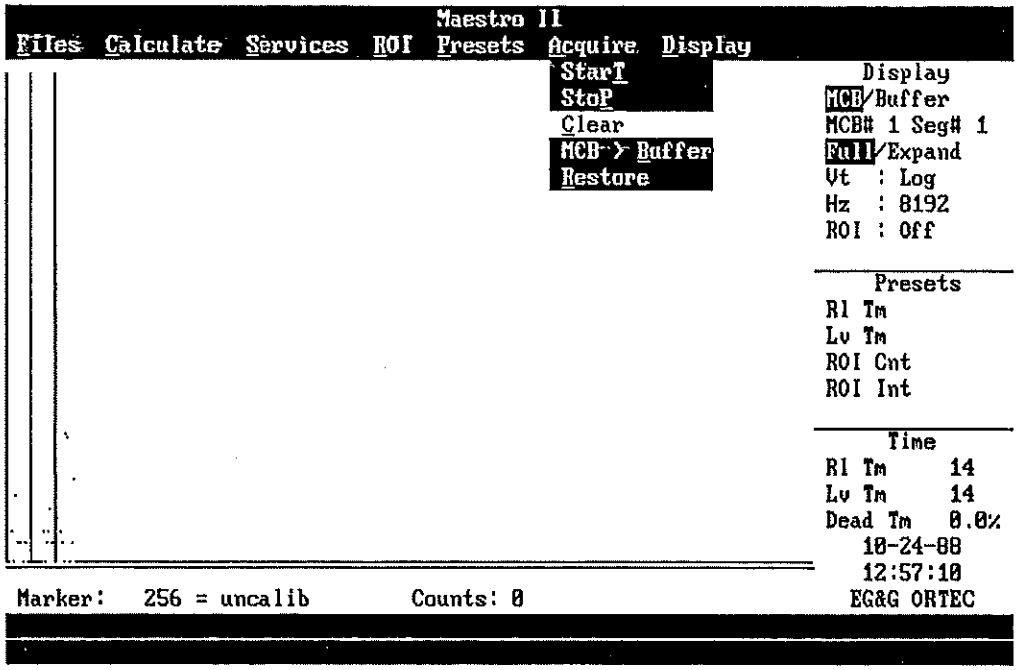


Figure 8. CLEAR Data

This command clears (erases) the data, including the realtime and livetime for all the segments in the display for the selected MCB. If the MCB is segmented, and the display is in FULL mode, all the segments are stopped (see Display). If the system is in EXPANDED mode, only the segment displayed is stopped.

The presets are not altered.

CLEAR is automatically disabled for any MCB or segment that is collecting data.

The data can also be cleared by <Alt 3>.

Acquire <Alt A>

MCB > Buffer <Alt B>

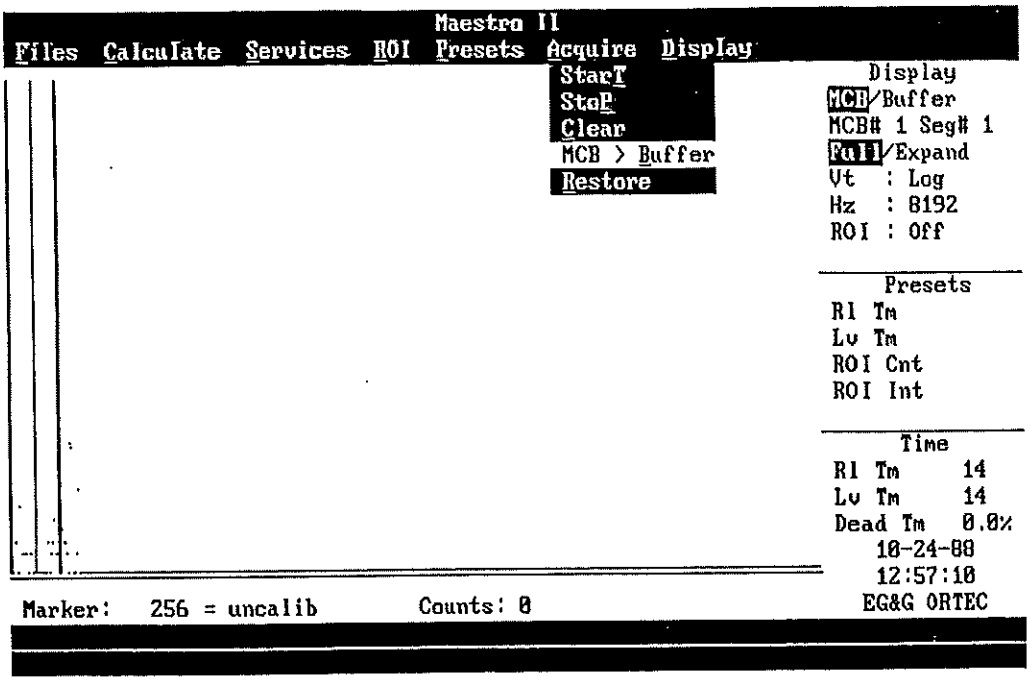


Figure 9. MCB to Buffer Transfer

This command transfers data from the selected MCB to the PC's internal Buffer. The data can also be transfered by <Alt 5>.

If the MCB is not segmented, all the data are transferred whether in FULL or EXPANDED mode.

If the display is in FULL mode, all the data are transferred whether the MCB is segmented or not.

If the display is expanded and segmented, only the active segment is transferred. The active segment is the segment with the marker, as indicated in the upper right of the screen.

The livetime and realtime and the Preset values for the transferred data are also transferred.

Acquire <Alt A>

Restore <Alt R>

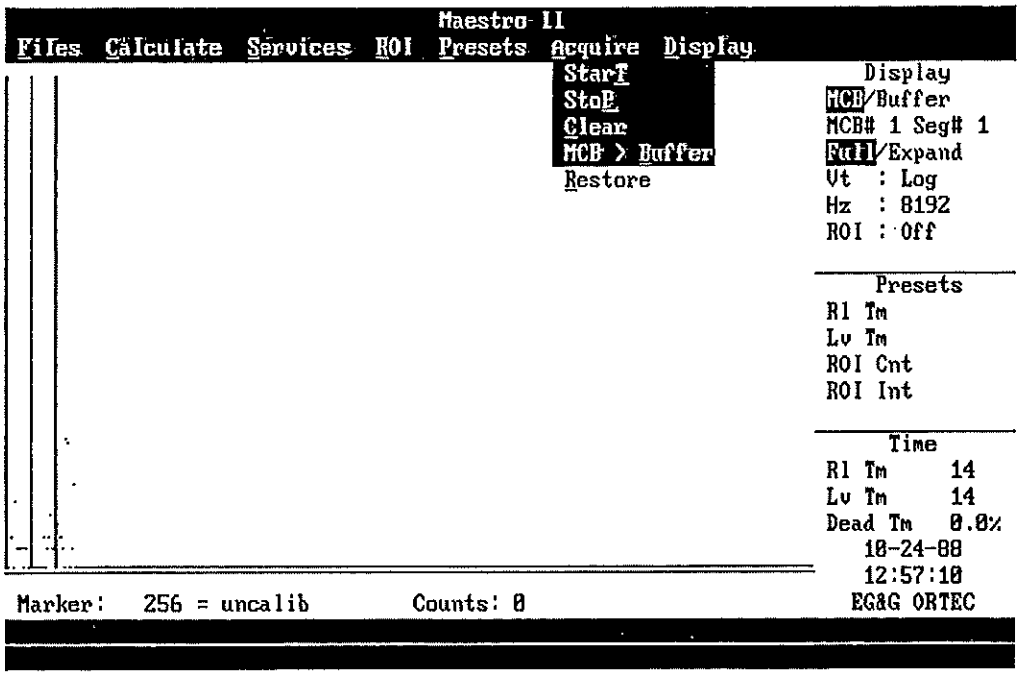


Figure 10. Restore Data to MCB

This command copies the contents of the internal Buffer to the active MCB. In FULL mode the entire Buffer is copied. In EXPANDED mode only the active segment is copied. The old data in the MCB is lost.

The livetime and realtime are written into the MCB if it is not counting.

The program asks (see Figure 11) for approval of the transfer. A "Y" <Enter> answer copies the contents; any other reply aborts the operation with no action.

If the internal Buffer data size is not the same as the MCB data size (i.e., the Buffer is 4096 channels and the MCB is 16384 channels) then the transfer is not done.

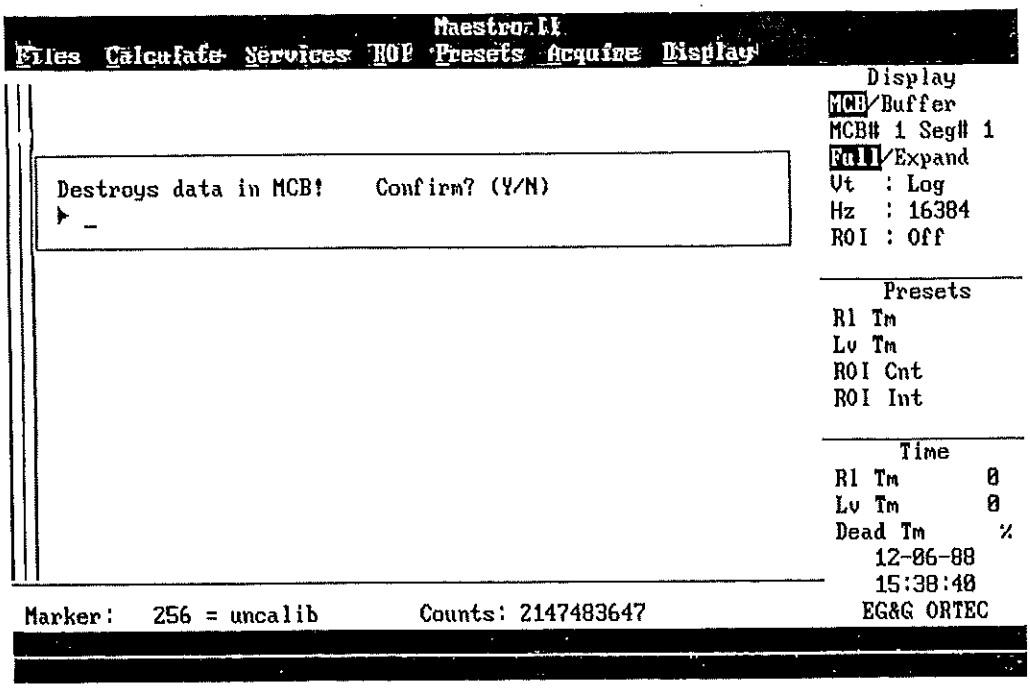


Figure 11. Restore Data Verification

Acquire <Alt A>

Gain Stblzr (919 & 92X) <Alt G>

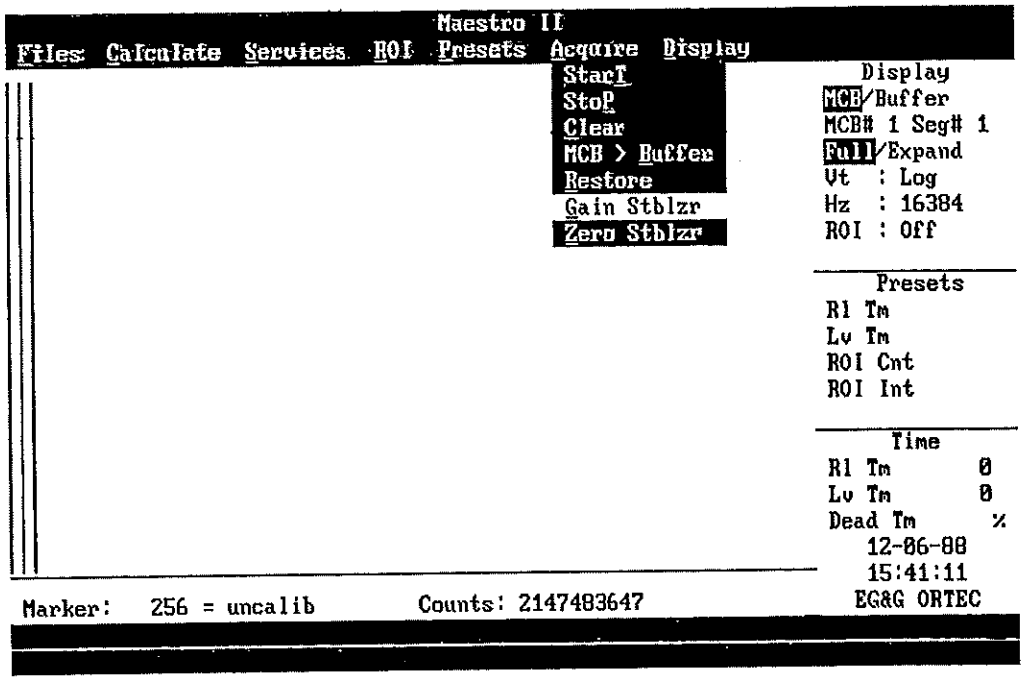


Figure 12. Control of the Gain Stabilizer

This command enables the operator to control the gain stabilizer on the 919 and 92X MCBs. The gain stabilizer uses a peak in the spectrum to monitor the changes in the gain of the system amplifier. The gain stabilizer controls the amplification factor of a separate amplifier so that the peak will be maintained in its original position. The input pulse height to channel number relationship is

$$\text{Channel number} = \text{Intercept} + \text{Gain} * \text{pulse height}$$

where

Intercept is	the channel number of the zero-height input pulse
Gain is	the relation between pulse height and channel number (slope of the curve)

Changes in either the intercept or gain can affect the positions of all the peaks in the spectrum. When used with the zero stabilizer, both the zero

intercept and the gain (slope) will be monitored to keep all the peaks in the spectrum stabilized. The zero stabilization and gain stabilization are separate functions in the MCB but both will affect the position of the peaks in the spectrum.

The stabilization operates by keeping a peak centered in an ROI defined by the operator. The ROI should be made symmetrically about the center of a peak with reasonably good count rate in the higher channels of the spectrum. The ROI should be about twice the FWHM of the peak. If the region is too large, then counts not in the peak will have an effect on the stabilization. The ROI can be cleared after the PEAK command, if needed (e.g., so that peak count preset can be used on another peak).

The coarse and fine gains should be set to the desired values and the pole zero should be triggered before setting either stabilization peak. On the 92X this is done from the Services menu; for the 919 this is done externally.

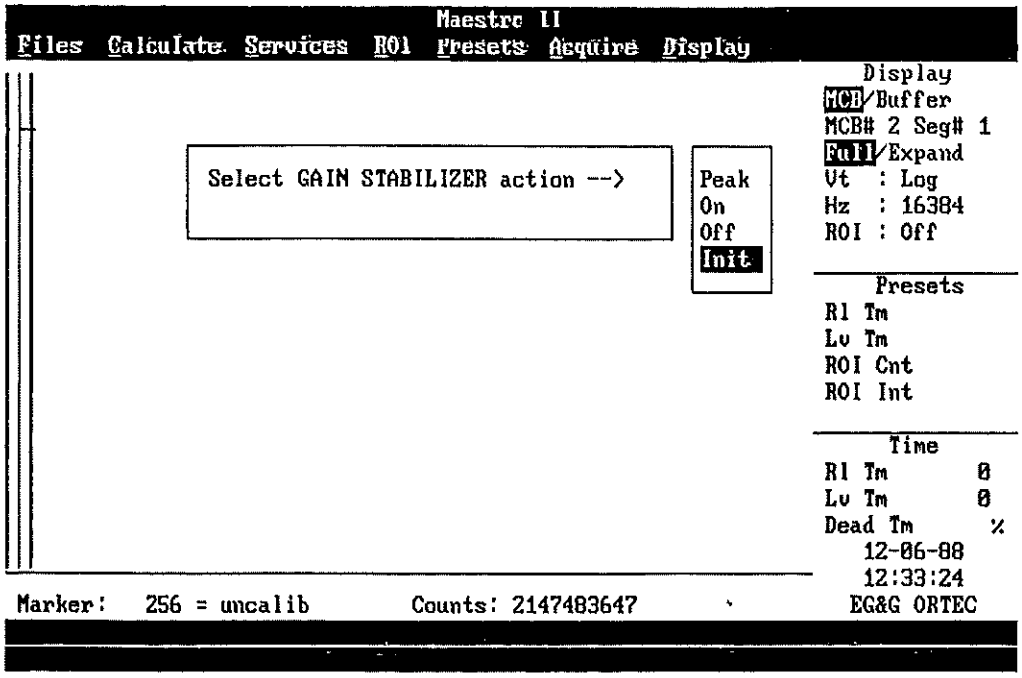


Figure 13. Gain Stabilizer Init Select

The gain stabilization Initialization (Init) command (see Figure 13) sets the gain on the stabilization amplifier to its midpoint; that is, halfway between minimum gain and maximum gain. This should be done before selecting the

ROI for the peak, as this may move the peak in the spectrum, and to ensure that the maximum range is available for the stabilization process. If the peak is moved by this command, use the amplifier fine gain control to move the peak to the desired channel (< Alt -> or < Alt + > on the 92X).

When starting a new system, the zero init(ialization) command should also be done before starting the gain stabilization.

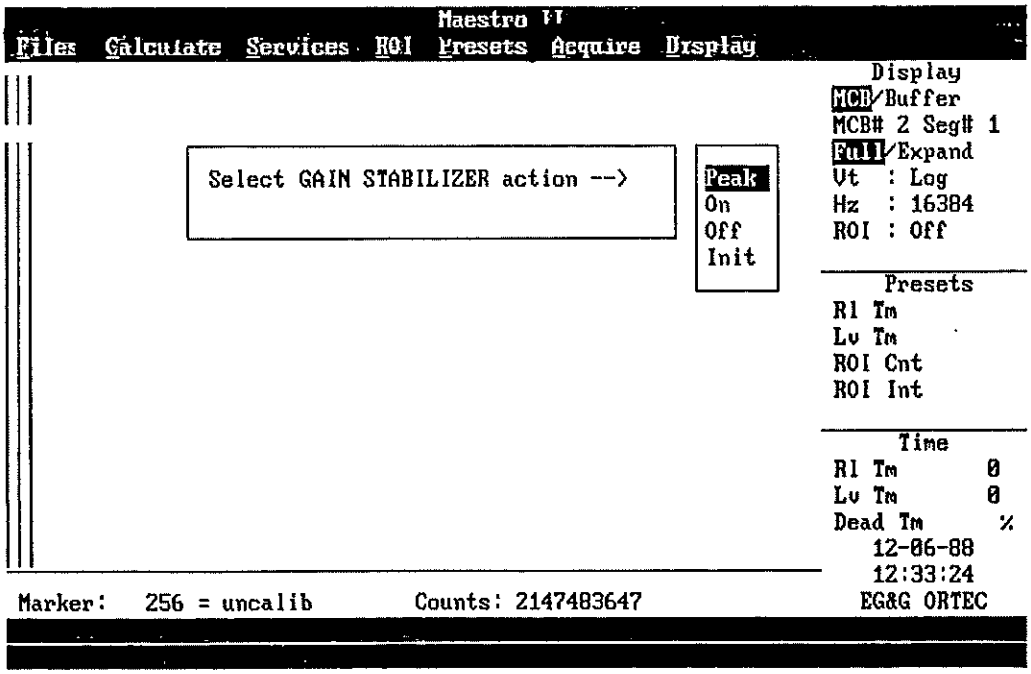


Figure 14. Gain Stabilizer Peak Select

The peak select command (see Figure 14) is used to set the peak center and peak width of the peak area used by the stabilizer. Before selecting this command, the ROI must be marked and the marker put in the region to be used. When operating, the peak will be centered in the ROI. After the region has been recorded the stabilization is turned on. If the stabilization is turned on when this command is executed, the old stabilization region is replaced by the new peak defined by the marker and stabilization continues using the new peak.

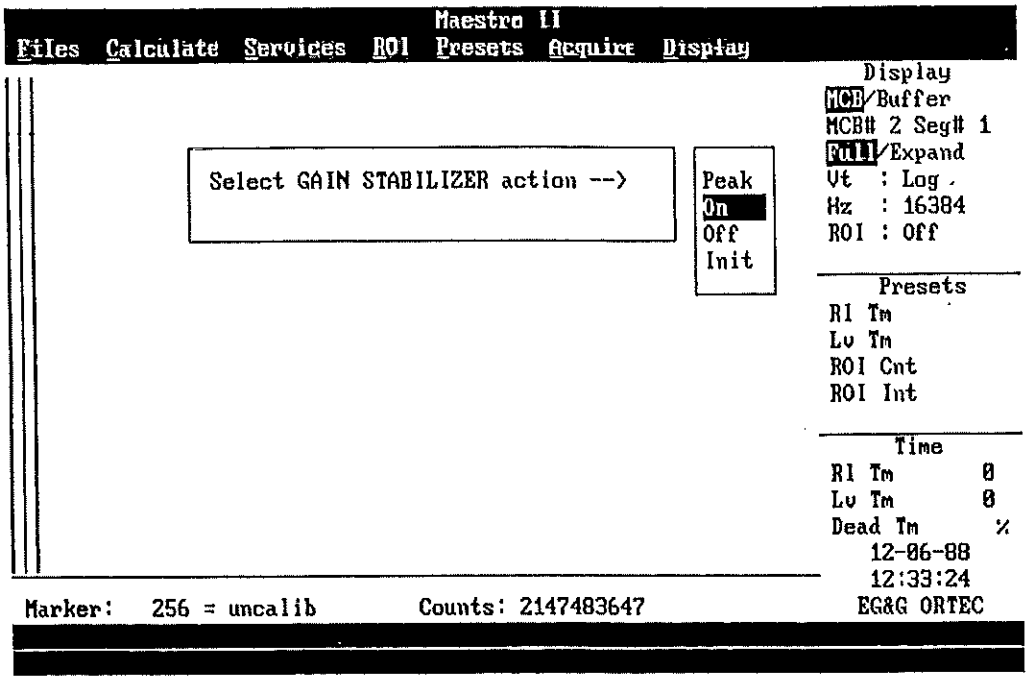


Figure 15. Gain Stabilizer On Select

This command enables the gain stabilization (see Figure 15). It is used to restart the stabilizer after it has been stopped by the Off command. It can only be used after the peak command has selected the peak to be used. If the MCB already has its gain stabilizer enabled, the command is rejected.

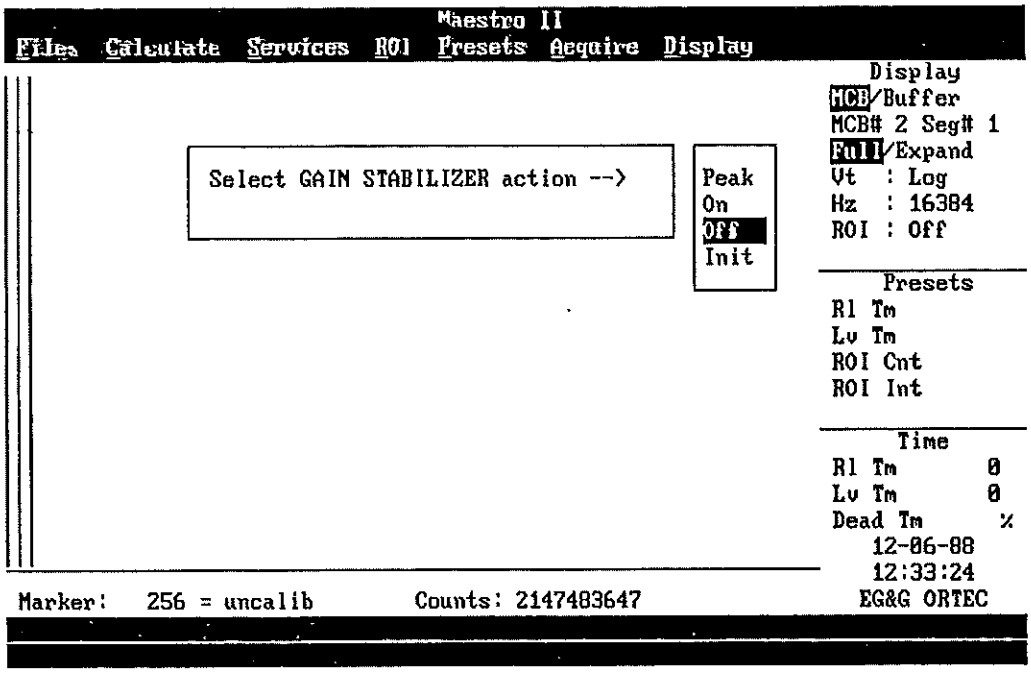


Figure 16. Gain Stabilizer Off Select

This command disables the gain stabilizer (see Figure 16). It does not alter the peak ROI position or range or the current stabilizer settings.

Acquire <Alt A>

Zero Stblzr (919 & 92X) <Alt Z>

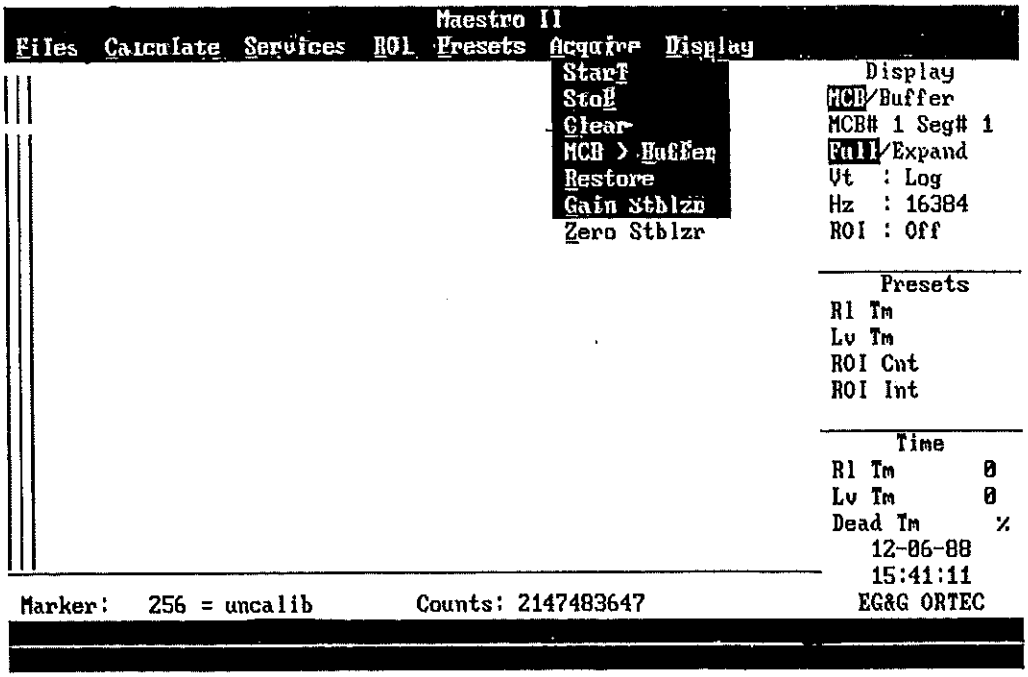


Figure 17. Control of the Zero Stabilizer

This command enables the operator to control the zero level (or offset) stabilizer on the 919 and 92X MCBs. The zero level stabilizer uses a peak in the spectrum to monitor the changes in the zero level of the system amplifier. The zero stabilizer controls offset bias level so that the peak will be maintained in its original position. The input pulse height to channel number relationship is

Channel number = Intercept + Gain * pulse height

where

Intercept is	the channel number of the zero-height input pulse
Gain is	the relation between pulse height and channel number (slope of the curve)

Changes in either the zero intercept or gain can affect the positions of all the peaks in the spectrum. When used with the gain stabilizer both the zero

intercept and the gain (slope) will be monitored to keep all the peaks in the spectrum stabilized. The zero stabilization and gain stabilization are separate functions in the MCB but both will affect the position of the peaks in the spectrum.

The stabilization operates by keeping a peak centered in an ROI defined by the operator. The ROI should be made symmetrically about the center of a peak with reasonably good count rate in the lower channels of the spectrum. The ROI should be about twice the FWHM of the peak. If the region is too large, then counts not in the peak will have an effect on the stabilization. The ROI can be cleared after the PEAK command, if needed (e.g., so that peak count preset can be used on another peak).

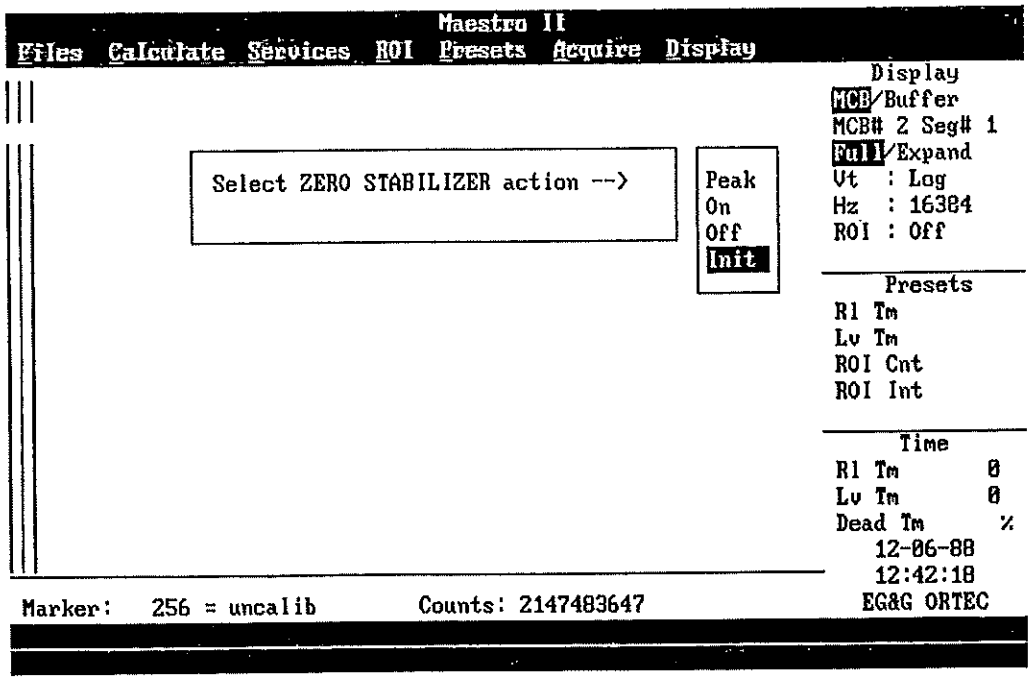


Figure 18. Zero Stabilizer Init Select

The zero stabilization Initialization (Init) command (see Figure 18) sets the zero offset to its midpoint; that is, halfway between minimum offset and maximum offset. This should be done before selecting the ROI for the peak, as this may move the peak in the spectrum, and to ensure that the maximum range is available for the stabilization process. If the peak is moved by this command, use the amplifier fine gain control to move the peak to the desired channel (<Alt -> or <Alt + > on the 92X).

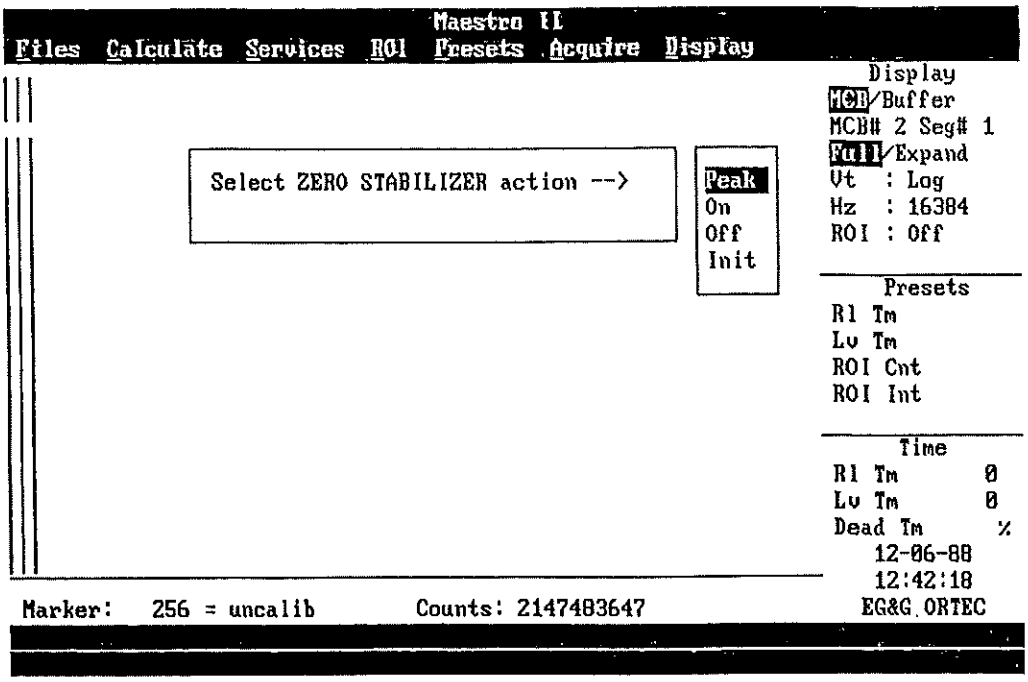


Figure 19. Zero Stabilizer Peak Select

The peak select command (see Figure 19) is used to set the peak center and peak width of the peak area used by the stabilizer. Before selecting this command, the ROI must be marked and the marker put in the region to be used. When operating, the peak will be centered in the ROI. After the region has been recorded the stabilization is turned on. If the stabilization is turned on when this command is executed, the old stabilization region is replaced by the new peak defined by the marker and stabilization continues using the new peak.

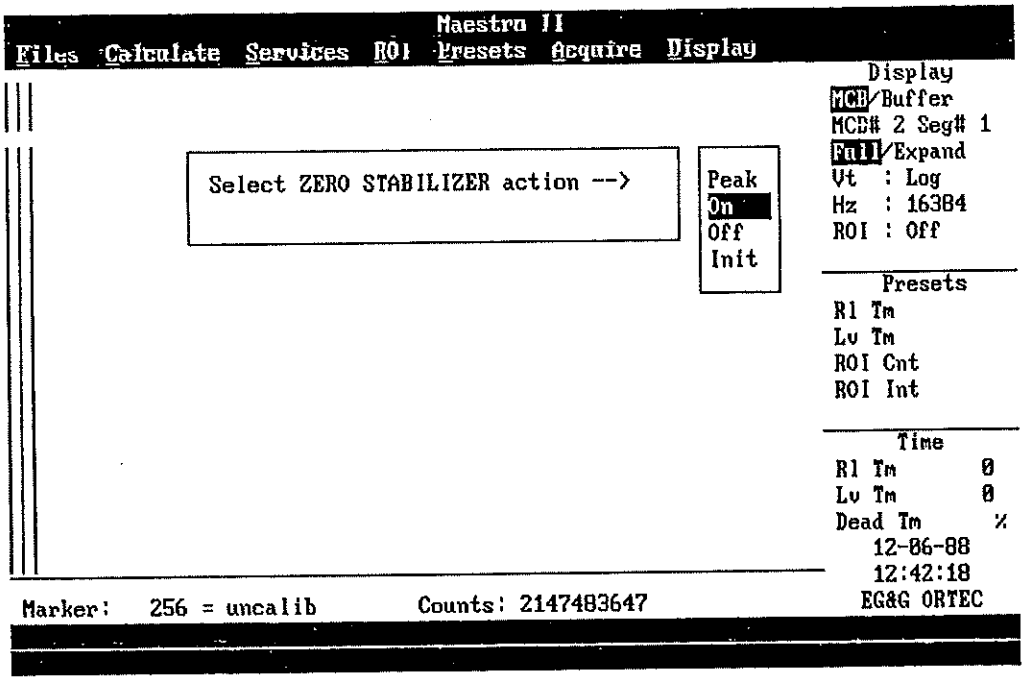


Figure 20. Zero Stabilizer On Select

This command enables the zero stabilization (see Figure 20). It is used to restart the stabilizer after it has been stopped by the Off command. It can only be used after the peak command has selected the peak to be used. If the MCB already has its zero stabilizer enabled, the command is rejected.

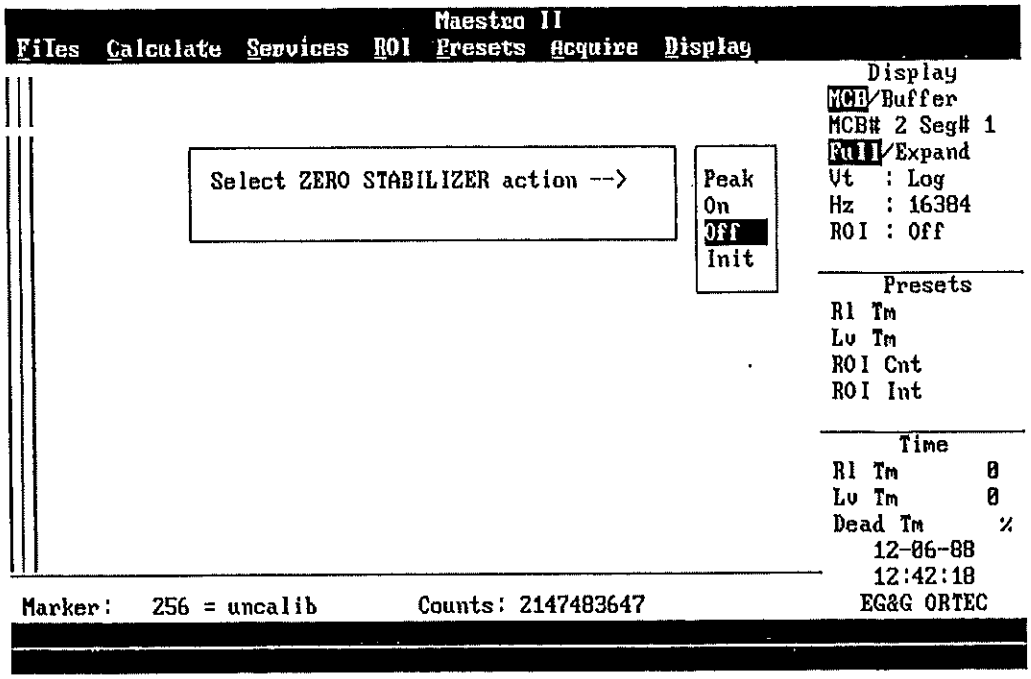


Figure 21. Zero Stabilizer Off Select

This command disables the zero stabilizer (see Figure 21). It does not alter the peak ROI position or range or the current stabilizer settings.

Display <Alt D>

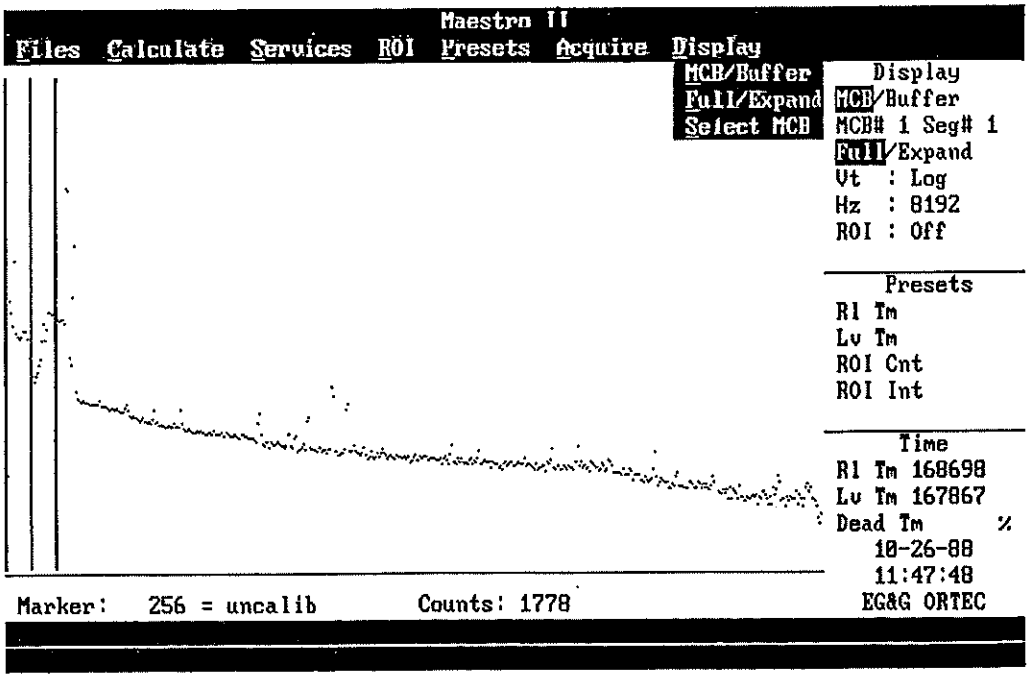


Figure 22. Display Menu

The <Alt D> pulls down the Display menu. This menu is shown in Figure 22. The Display functions are available for either the internal Buffer or the MCB/Segment.

Two of the most important functions of the MAESTRO II program are to display the spectrum data and to provide an easy and straightforward way to manipulate the data. The display can be controlled by this menu and by single function keys (hot keys). The hot keys are shown in Table 2 and Table 3 above, and explained later in this section.

When this menu is displayed, the screen display is not updated. Use the <up arrow> and <down arrow> to select the menu item and <Enter> to perform the action. The <left arrow> moves to the Acquire menu and the <right arrow> moves to the Files menu. The <Esc> clears the menu without any action, redraws the spectrum display and exits the menu mode.

Display <Alt D>

MCB/Buffer <Alt M>

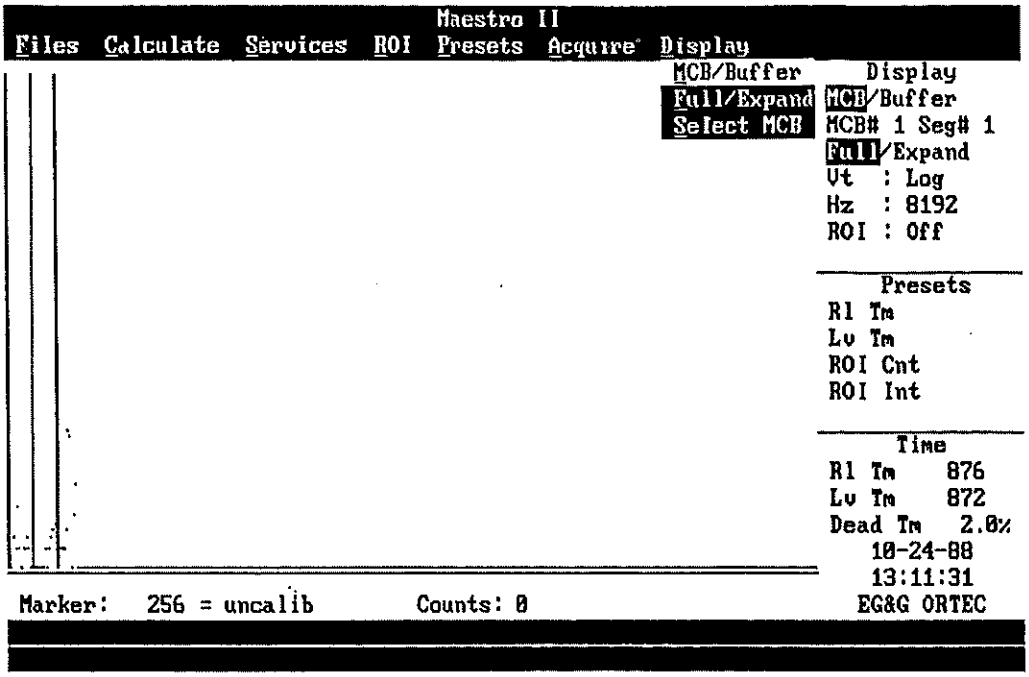


Figure 23. Switch Between MCB and Buffer

This command switches between the display of the data in the MCB and the data in the PC's internal Buffer. The Buffer will have the memory size and segmentation of the spectrum that was last transferred (or read from disk). At start up, the Buffer is defined as 16384 channels and one segment.

The emulation displays the data in histogram form from either the selected MCB or the internal Buffer. The status of the display (MCB or IBM PC Buffer) is shown in reverse video on the right of the screen. The livetime, realtime, presets and deadtime (MCB only) are shown for the displayed data. The marker remains in the same channel in both views unless the PC Buffer and MCB do not have the same segmentation. The FULL/EXPANDED status and the vertical scale are the same in both views.

For menu functions that work only on the Buffer or MCB data, the program automatically switches to the correct display.

See also Select MCB and FULL/EXPAND.

The display can also be toggled with <Alt 6>.

Display <Alt D>

Serial Xfer <Alt X>

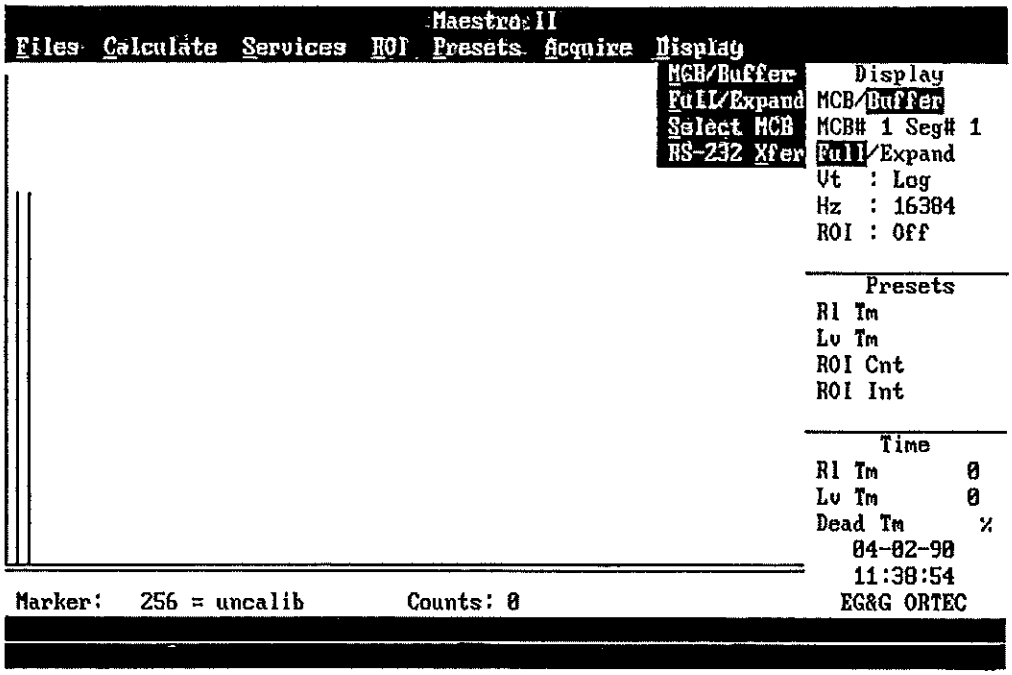


Figure 23B. Serial Mode Transfer

In the serial-only (Remote MCB, MCASER) program, this function transfers the contents of the MCB to the local display area (this is not the buffer).

In the serial-only setup, in which the MCB is in a remote location, all of the commands and data are transmitted over the RS-232 line. In this mode, there is no live display. The spectrum in the display buffer can be manually updated by this function. Only the section of the memory displayed contains the updated data. In EXPANDED mode, only the displayed window is updated. In FULL mode, the complete buffer is transferred.

This function is only available on the SERIAL version.

Display < Alt D >

FULL/EXPAND < Alt F >

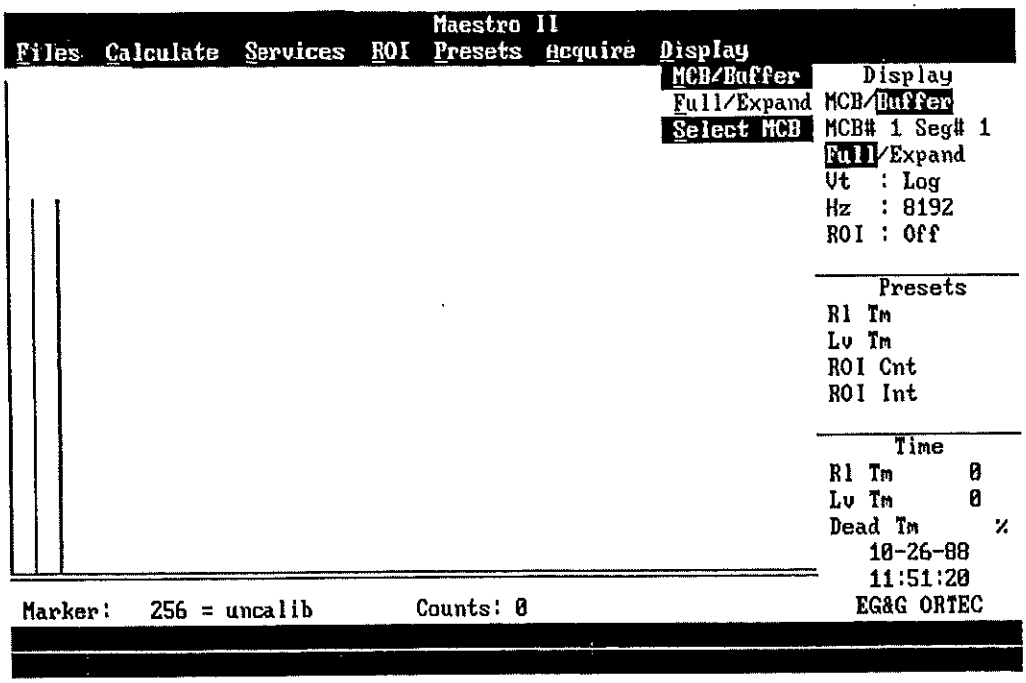


Figure 24. Full or Expanded Display

This command switches between FULL memory display and EXPANDED memory display and works on both the MCB and data Buffer memory. The full memory width automatically switches to the memory size defined in M2SETUP.

The section in the window of the FULL memory is expanded to fill the horizontal screen. The cursor is in the center of the screen. The width of the EXPANDED view is increased (more channels, narrower peaks) by <F7> or <keypad -> and decreased (fewer channels, wider peaks) by <F8> or <keypad + >.

The status of the FULL or EXPANDED display is shown highlighted on the upper right of the screen.

Display < Alt D >

Select MCB < Alt S >

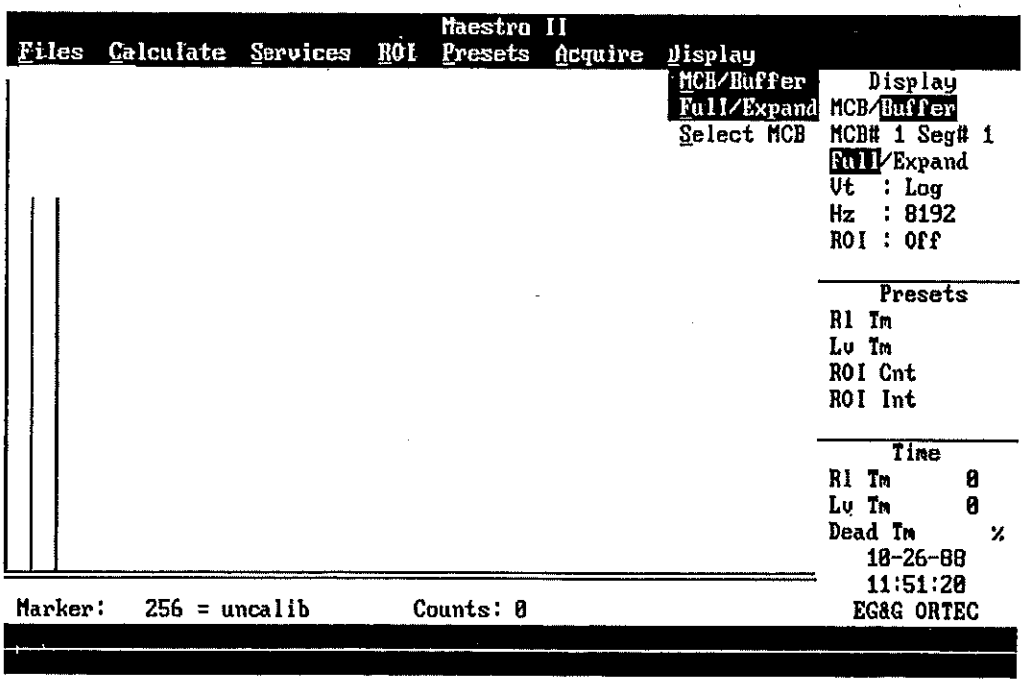


Figure 25. Select Active MCB

This command selects the active MCB for display and switches to that MCB. If only one MCB was defined in the system (see M2SETUP) then this command is the same as MCB/Buffer.

If an MCB is selected that has not been defined, the command is rejected.

The active MCB can also be selected by <Ctrl F1> for MCB #1, <Ctrl F2> for MCB #2 and so on through <Ctrl F8>.

Preset <Alt P>

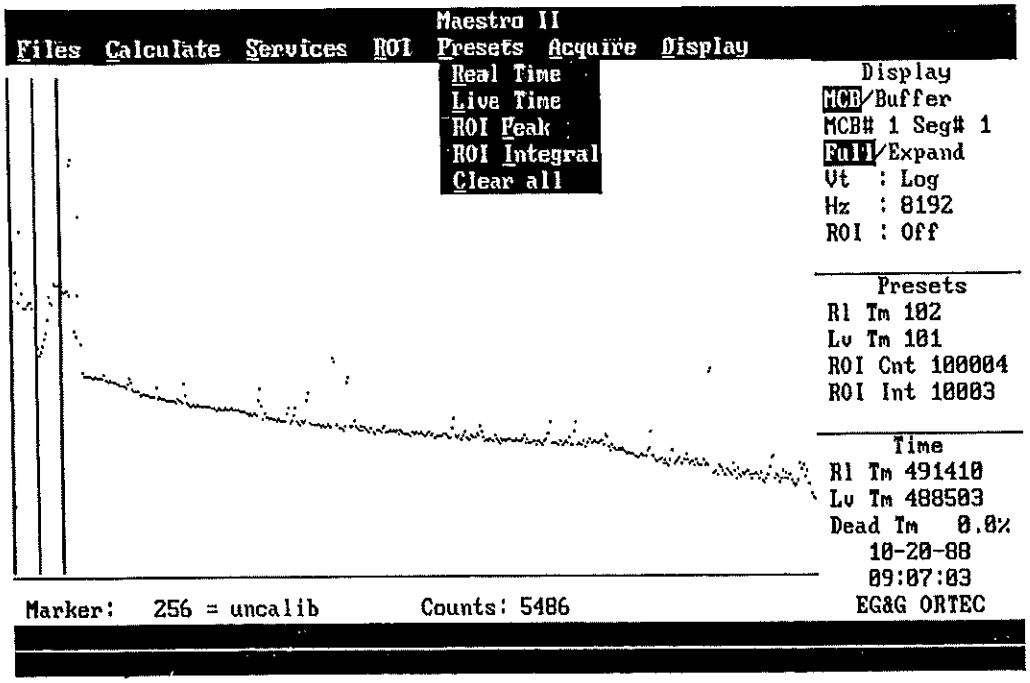


Figure 26. Preset Menu

The <Alt P> pulls down the Preset menu. This menu is shown in Figure 26. If the Buffer is selected, the spectrum display is switched to the active MCB. The Preset functions are only valid for an MCB/Segment.

In the 916, 916A, 917, 918, and the 918A, the preset values are buffered and only updated in the MCB/Segment when the MCB/Segment is started. If the MCB is counting, it is necessary to stop and restart the acquisition fo the new presets to be effective. For the 919 and 92X, the preset values are not buffered and can only be changed when the unit is not counting.

All of the presets may be enabled simultaneously. This can be useful when samples of widely varying activity are analyzed and the general activity is not known before counting. For example, the livetime preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, then the deadtime can be high, resulting in a long counting time for the sample. By setting the realtime preset in

addition to the livetime preset, the low level samples will be counted to the desired fixed livetime while the very active samples will be counted for the realtime. In this case the realtime preset could be viewed as a safty valve.

The preset values are read from the MCBs each time the MAESTRO II program is exited and restarted. This does not affect the operation of the MCB.

In a segmented MCB, all the segments are affected if the display is in FULL mode when the presets are set. In EXPANDED mode, only the presets for the selected segment are updated.

When this menu is displayed, the screen display is not updated. Use the <Alt> and the underscored letter to perform the function or use the <up arrow> and <down arrow> to select the menu item and <Enter> to perform the action. The <left arrow> moves to the ROI menu and the <right arrow> moves to the Acquire menu. The <Esc> clears the menu without any action, redraws the spectrum display and returns to the monitoring mode.

Preset <Alt P>

Realtime <Alt R>

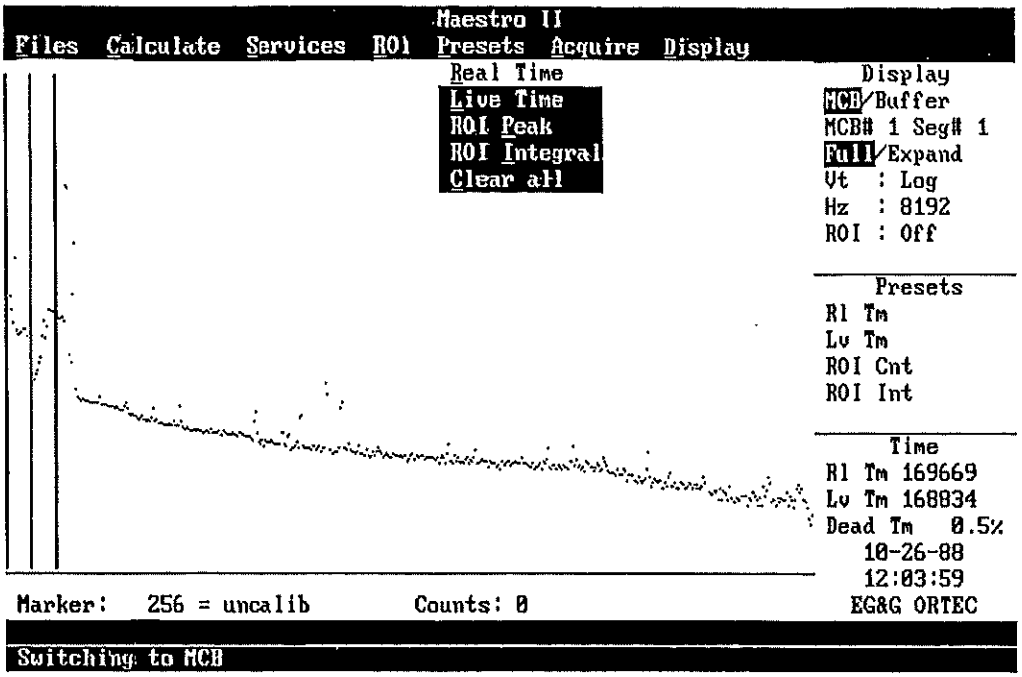


Figure 27. Realtime Setting

This command is used to enter the realtime preset for the active MCB/Segment. If the display is in FULL mode, the preset is set for all segments for the active MCB. The individual segments may have different preset values. If the display is EXPANDED, only the segment shown (with the marker) will be updated. The MCB/Segment stops counting when the realtime reaches the preset value.

See note on the differences among the MCBs in <Alt P>.

The preset value for the active MCB/Segment is shown at the center right of the screen.

The preset value is entered in seconds and fractions-of-a-second. The MCB clock is stored in 50 millisecond increments.

If used in conjunction with other preset conditions, the first condition met causes the MCB to stop.

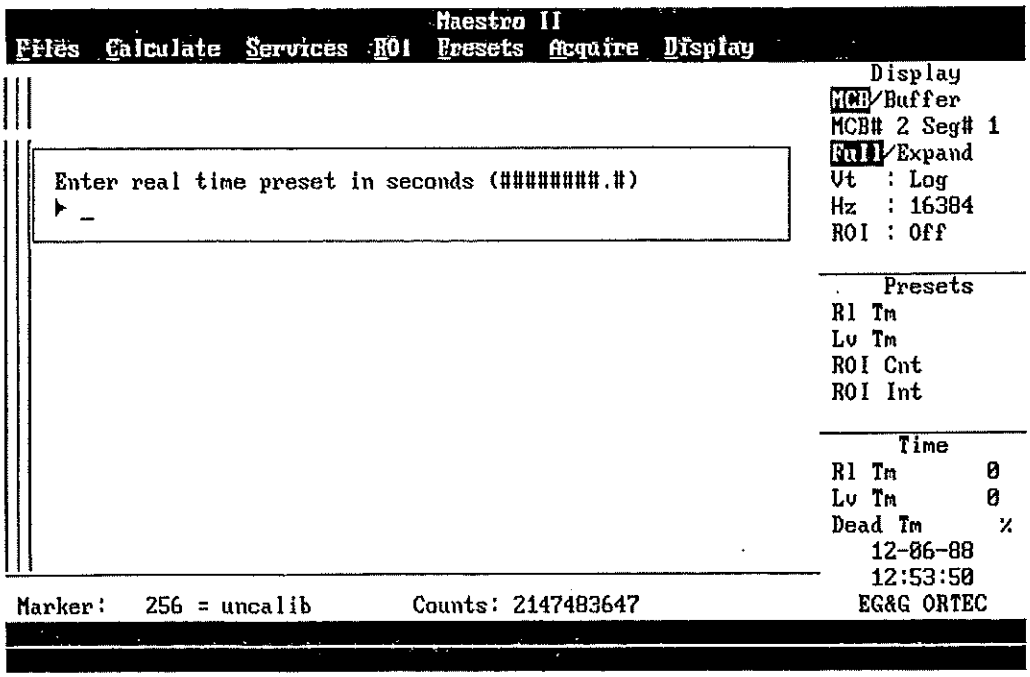


Figure 28. Realtime Seconds Entry

After selecting the realtime input, the screen in Figure 28 is displayed so that the desired time, followed by <Enter>, can be entered. The input can be in scientific notation (i.e., 1.0E2) so long as the first character is a number. Typing just <Enter> or any invalid input will exit this input without altering the current preset value.

To turn the preset off, enter a 0 and <Enter>.

Preset <Alt P>

Livetime <Alt L>

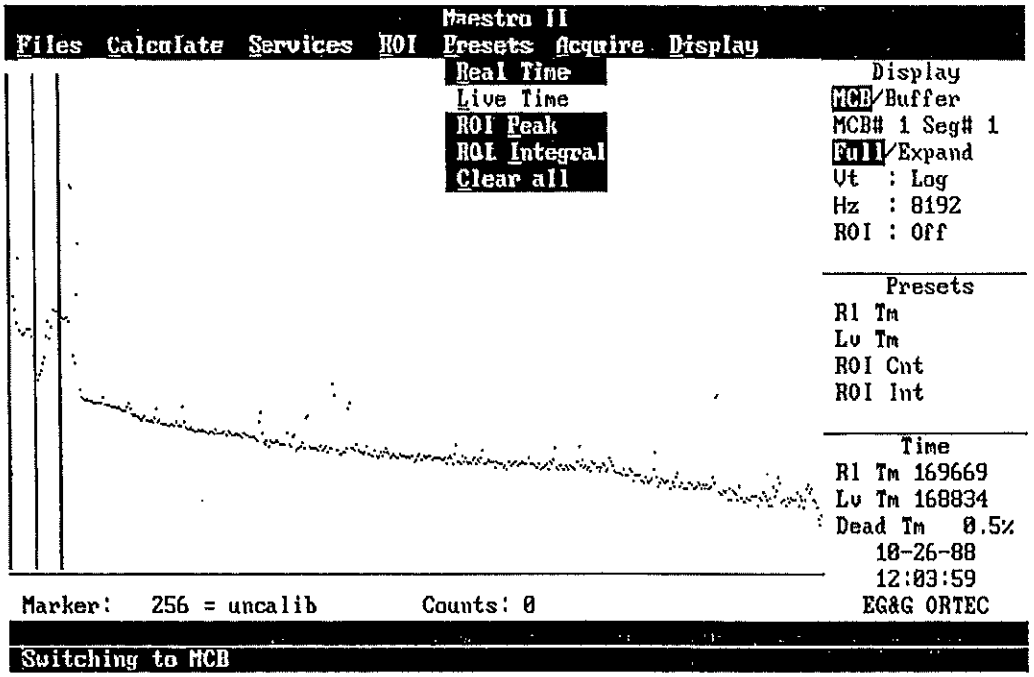


Figure 29. Livetime Entry

This command is used to enter the livetime preset for the active MCB/Segment. If the display is in FULL mode, the preset is set for all segments for the active MCB. If the display is EXPANDED, the preset is only updated in the active segment. The MCB stops counting when the livetime reaches the preset value. The livetime is the realtime minus the deadtime.

See note on the differences among the MCBs in <Alt P>.

The preset value for the active MCB/Segment is shown at the center right of the screen.

The preset value is entered in seconds and fractions-of-a-second. The MCB clock is stored in 50 millisecond increments.

If used in conjunction with other preset conditions, the first condition met causes the MCB to stop.

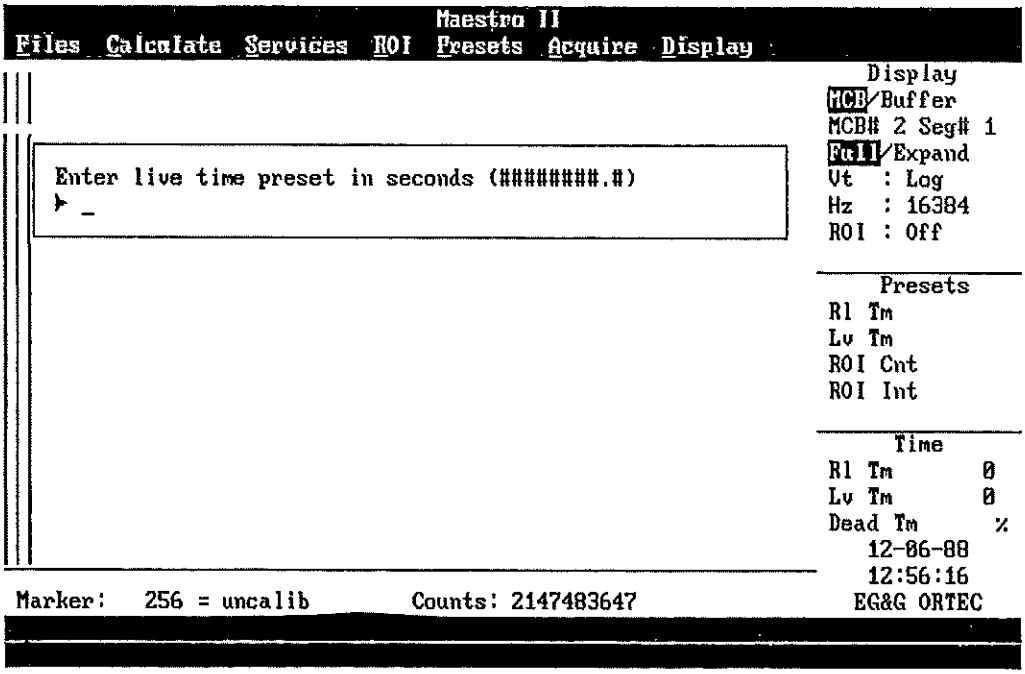


Figure 30. Livetime Seconds Entry

After selecting the livetime input, the screen in Figure 30 is displayed so that the desired time, followed by <Enter>, can be entered. The input can be in scientific notation (i.e., 1.0E2) so long as the first character is a number. Typing just <Enter> or any invalid input will exit this input without altering the current preset value.

To turn the preset off, enter a 0 and <Enter>.

Preset <Alt P>

ROI PEAK COUNT <Alt P>

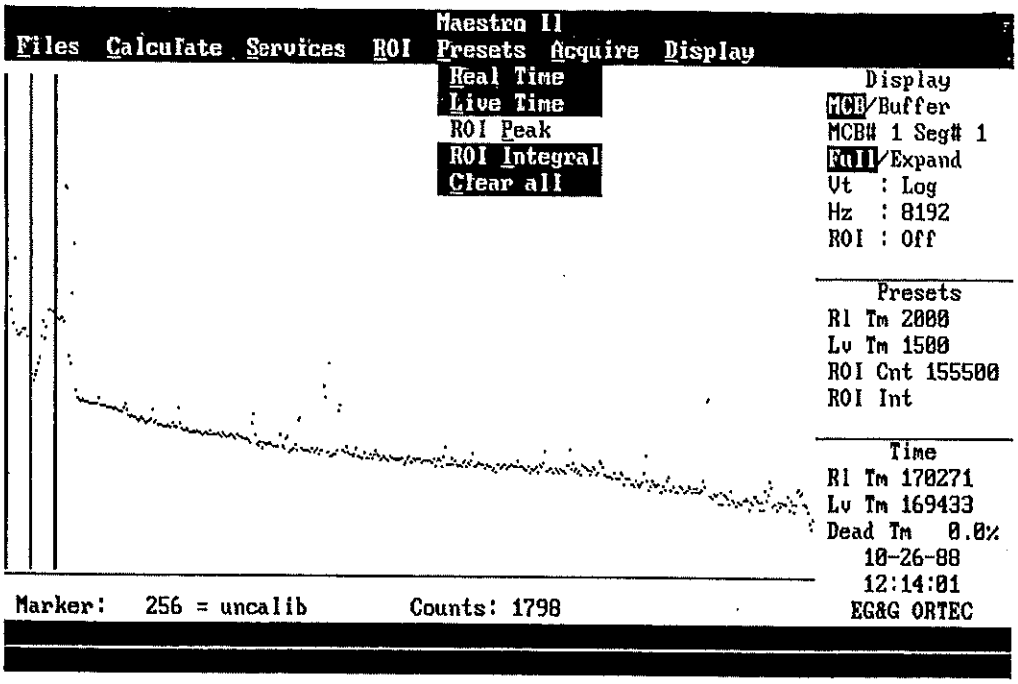


Figure 31. ROI Peak Count

This command is used to enter the ROI Peak Count preset for the active MCB/Segment. If in FULL mode, the preset is set for all segments for the active MCB. If the display is EXPANDED, the preset is only updated in the active segment.

With this preset condition, the MCB stops counting when any ROI channel reaches this value. If no ROIs are marked in an MCB/Segment, then that MCB/Segment never encounters this condition.

The preset value for the active MCB/Segment is shown in the center on the left of the screen.

See note on the differences among the MCBs in <Alt P>.

The preset value is entered in counts.

If used in conjunction with other preset conditions, the first condition met causes the MCB to stop.

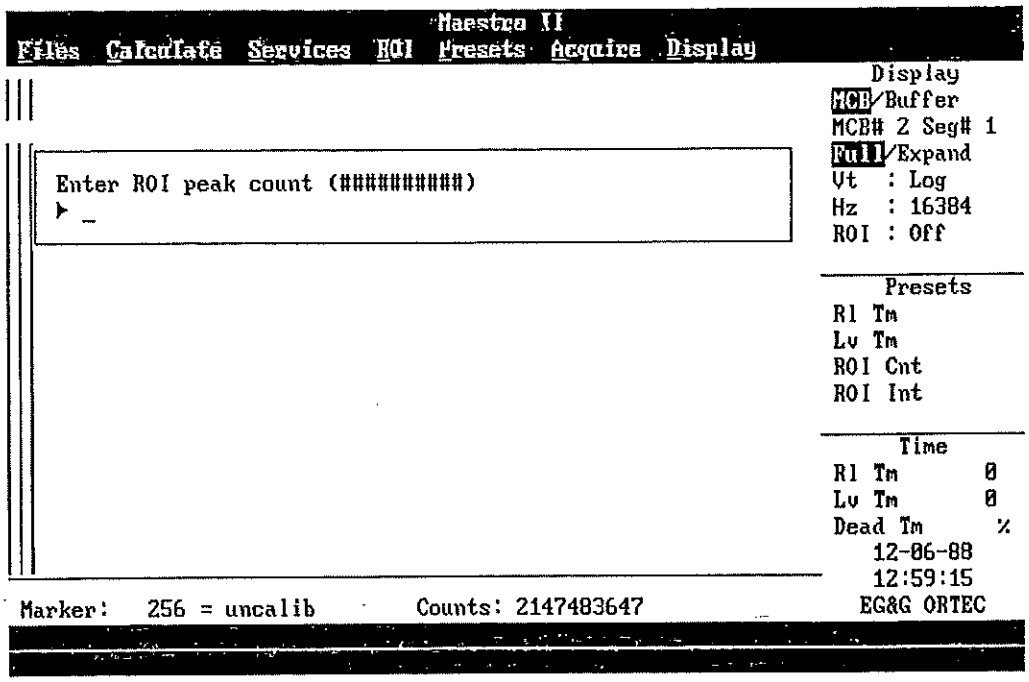


Figure 32. ROI Peak Count Entry

After selecting the ROI Peak Count input, the screen in Figure 32 is displayed so that the desired count, followed by <Enter>, can be entered. The input is in integer form. Typing just <Enter> or any invalid input will exit this input without altering the current preset value.

To turn the preset off, enter a 0 and <Enter>.

Preset <Alt P>

ROI INTEGRAL <Alt I>

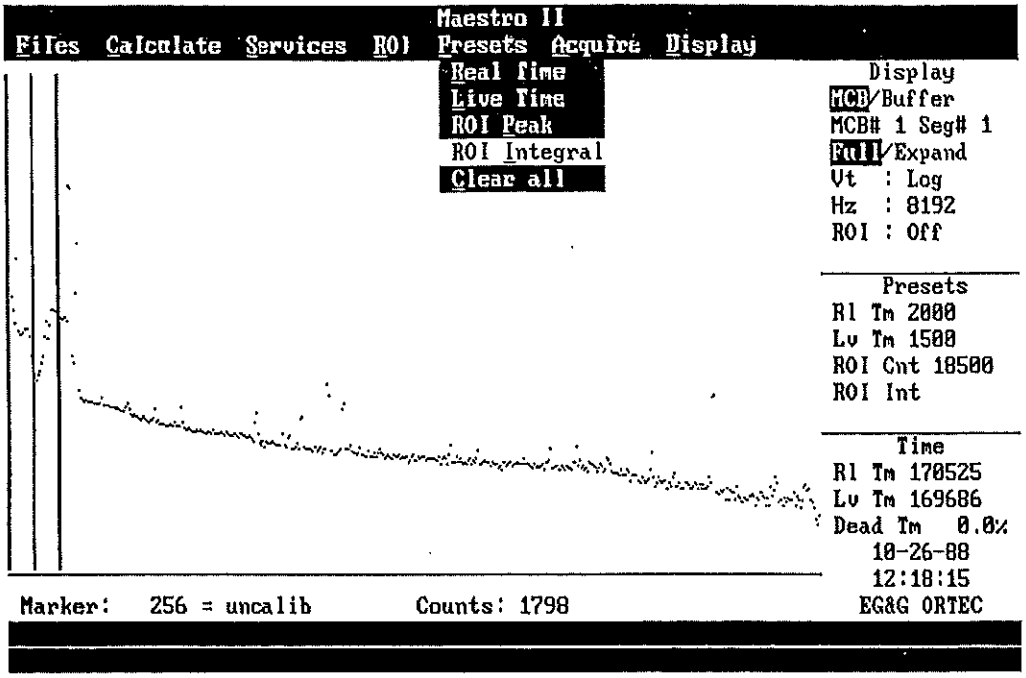


Figure 33. ROI Integral Count

This command is used to enter the ROI Integral preset value for the active MCB/Segment. If the display is in FULL mode, the preset is set for all segments for the active MCB. If the display is EXPANDED, the preset is only updated in the active segment.

With this preset condition, the MCB stops counting when the sum of all counts in all channels in this segment marked with a ROI reaches this value. If no ROIs are marked in the MCB/Segment, then that MCB/Segment never encounters this condition.

See note on the differences among the MCBs in <Alt P>.

The preset value for the active MCB/Segment is shown at the center right of the screen.

The preset value is entered in counts.

If used in conjunction with other preset conditions, the first condition met causes the MCB to stop.

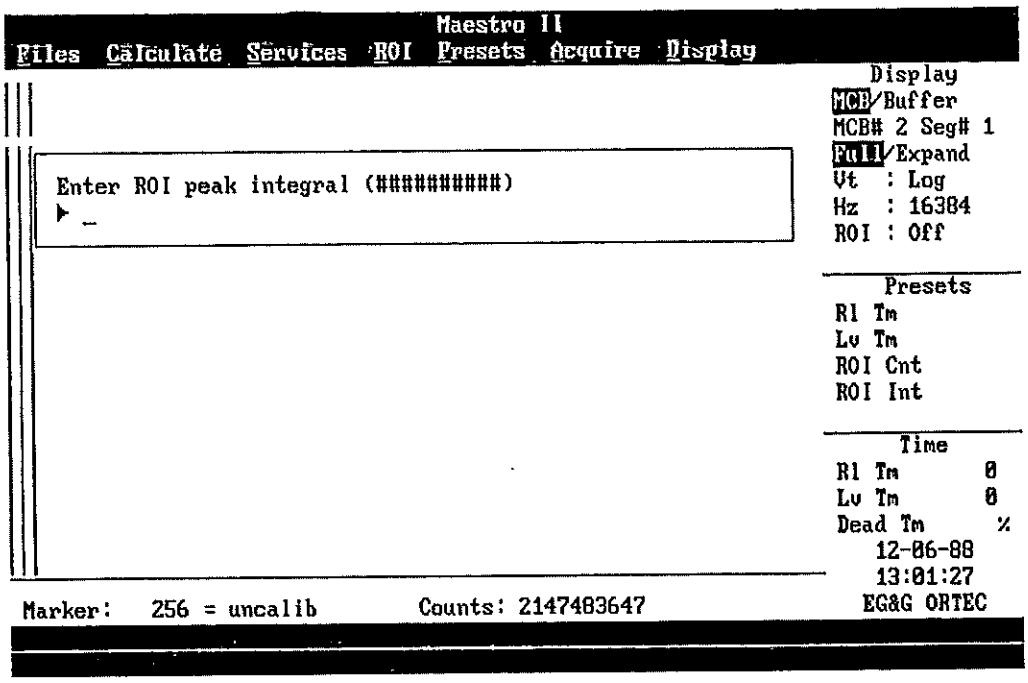


Figure 34. ROI Integral Count Entry

After selecting the ROI Integral Count Input, the screen in Figure 34 is displayed so that the desired count, followed by <Enter>, can be entered. The input is in integer form. Typing just <Enter> or any invalid input will exit this input without altering the current preset value.

To turn the preset off, enter a 0 and <Enter>.

Preset <Alt P>

CLEAR ALL <Alt C>

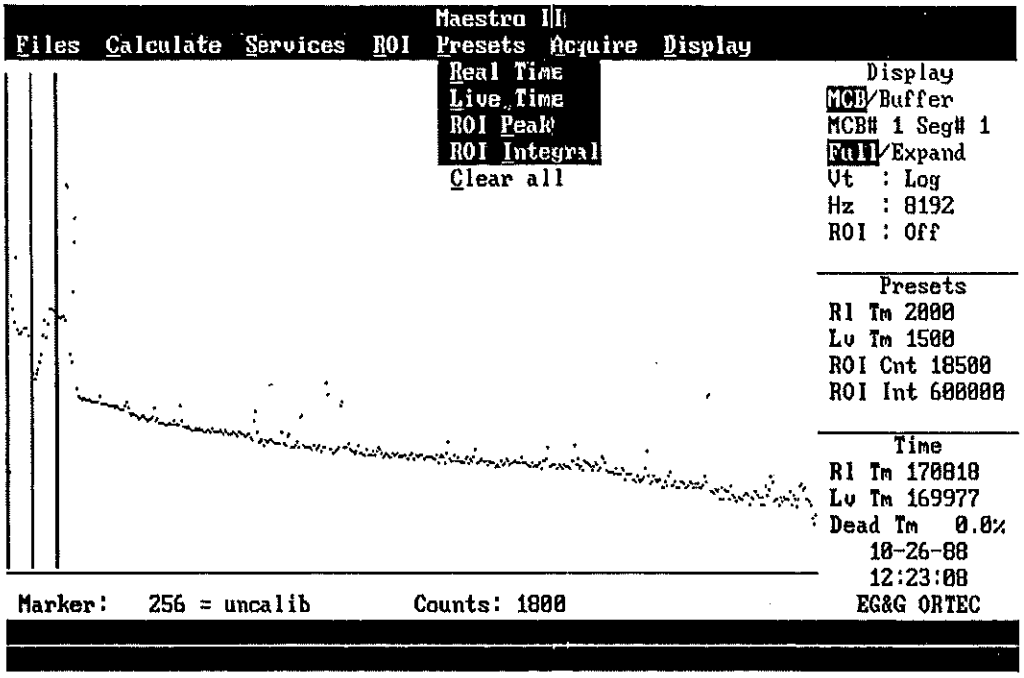


Figure 35. Clear All Presets

This command clears or sets to zero all the presets (including the overflow preset) in the MCB.

Clearing should be done so that unwanted preset values are not used by the MCB, causing the MCB to stop prematurely.

See the note on the differences among the MCBs in <Alt P>.

This command cannot be used on any type of MCB when it is acquiring data.

The preset values for the active MCB/Segment are shown at the center right of the screen.

ROI <Alt R>

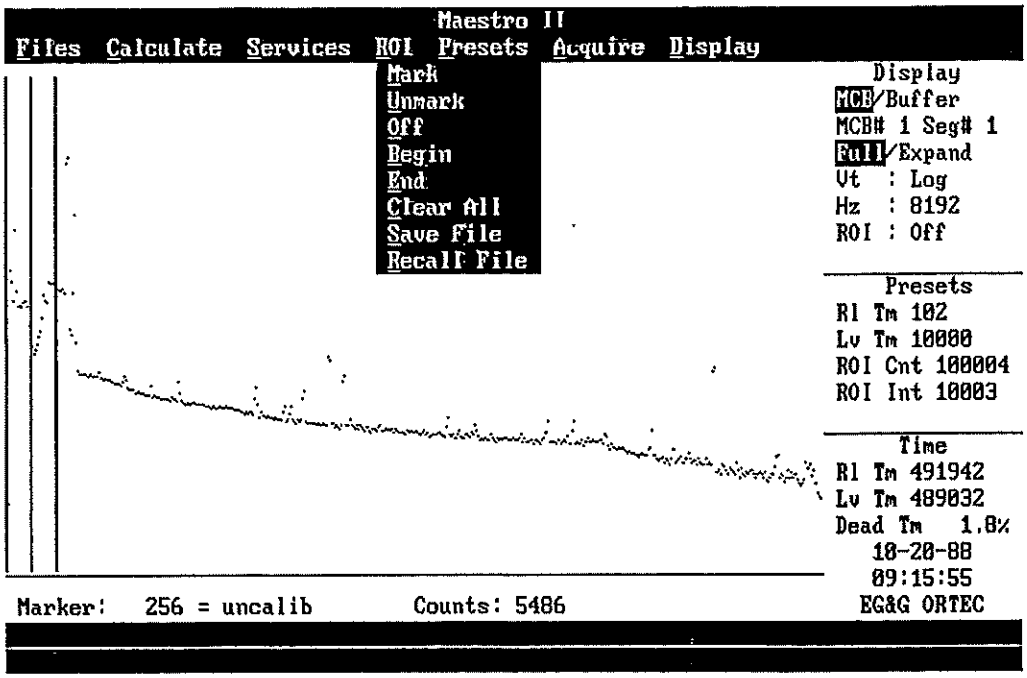


Figure 36. ROI Menu

The region of interest (ROI) is a way to denote channels or groups of channels as having special meaning. The ROI can be used to mark peak areas for the printout or to mark a peak to stop (Preset) when that peak gets to a set value. Channels marked as ROI channels are shown in a different color than the unmarked channels (see M2COLORS).

The <Alt R> pulls down the ROI menu. This menu is shown in Figure 36. If an MCB is being displayed, the spectrum displayed is switched to the Buffer. The ROI functions, except Save, are available for both the internal Buffer and an MCB/Segment.

When this menu is displayed, the screen display is not updated. Use the <Alt> and the underscored letter to perform the function or use the <up arrow> and <down arrow> to select the menu item and <Enter> to perform the action. The <left arrow> moves to the Services menu and the <right

arrow> moves to the Preset menu. The <Esc> clears the menu without any action, redraws the spectrum display and returns to the monitoring mode.

ROI <Alt R>

Mark <Alt M>

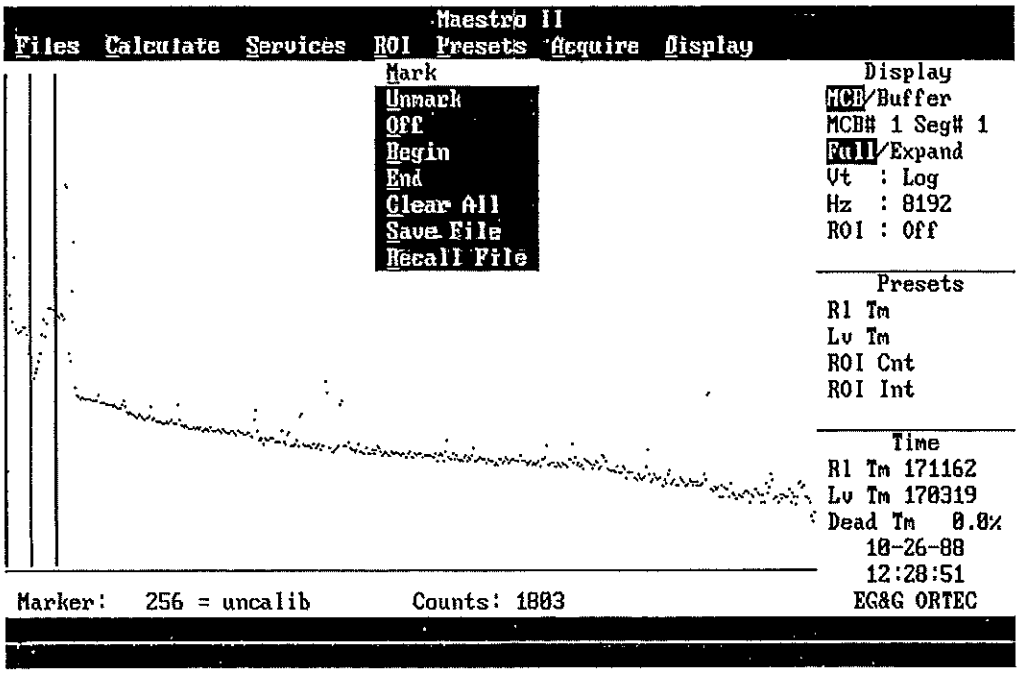


Figure 37. ROI Mark

This command sets the ROI status to the Mark or set condition. In this state, the cursor channels are marked with the ROI bit as the cursor is moved into the channel. This function is also altered by <F2>.

The ROI status is shown in the top of the screen on the right.

This command works on the MCB or the Buffer.

The marking of ROIs can also be done with the Begin command and with <Ins>. Begin/End is useful for large regions and <Ins> is used for peak regions.

ROI <Alt R>

Unmark <Alt U>

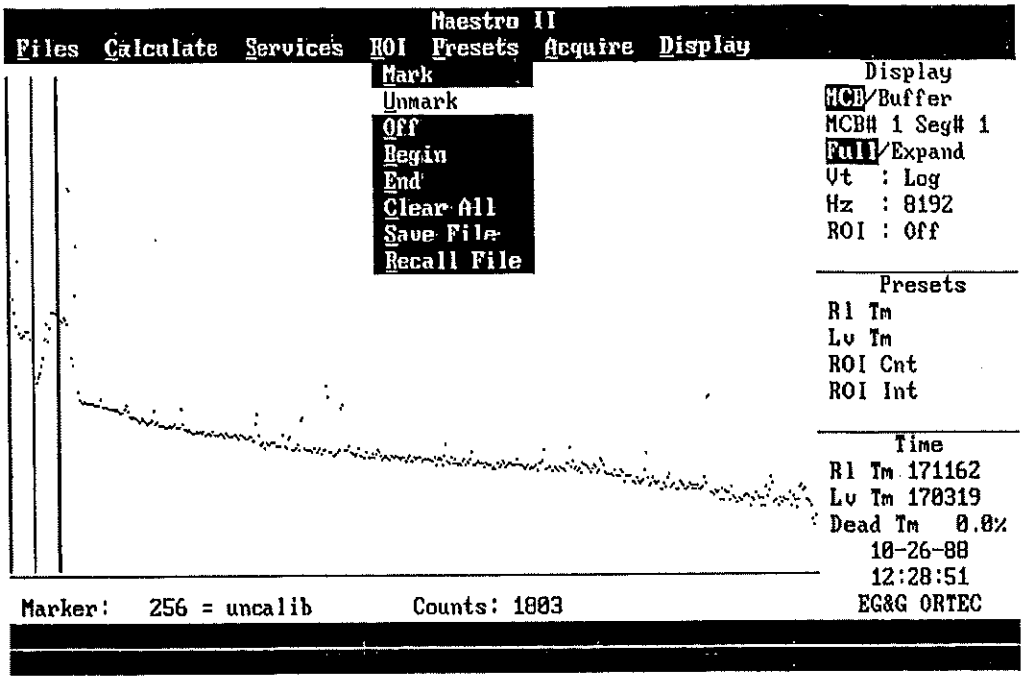


Figure 38. ROI Unmark

This command sets the ROI status to the unmark or reset condition. In this state, the channels are unmarked with the ROI bit as the cursor is moved into the channel. This function is also altered by <F2>.

The ROI status is shown in the top of the screen on the right.

This command works on the MCB or the Buffer.

ROI <Alt R>

Off <Alt M>

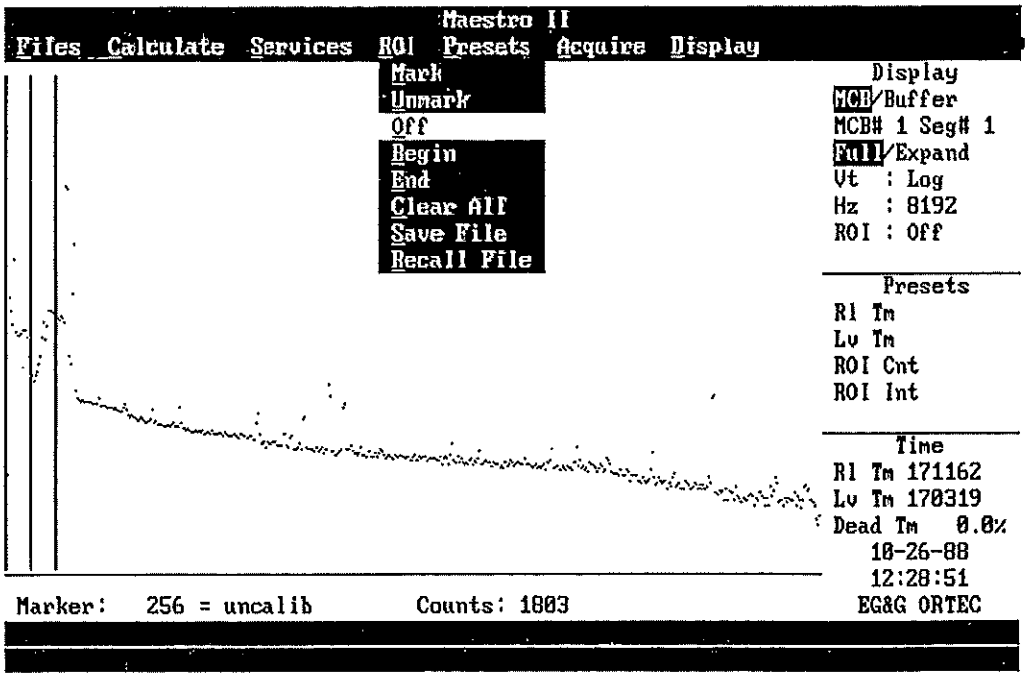


Figure 39. ROI Off

This command sets the ROI status to the Off condition. In this state, the ROI bit for the channels is unaltered by the cursor. This function is also altered by <F2>.

The ROI status is shown in the top of the screen on the right.

The usual ROI status is Off so that the marker can be moved on the display without changing any of the ROI bits.

This command works on the MCB or the Buffer.

ROI < Alt R >

Begin < Alt B >

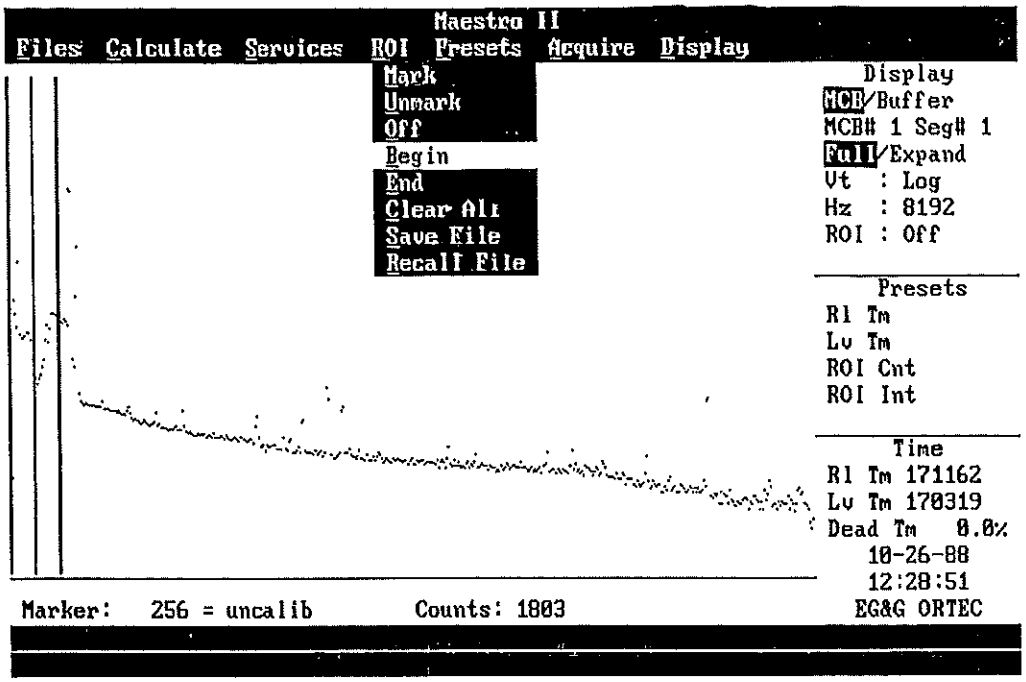


Figure 40. ROI Begin

This command is used to set ROIs between two channels. It is used with the End command to set the ROI bit on all the channels between the two channels in the active MCB/Segment or the Buffer. To set the region, locate one end of the region to be set with the marker and use the ROI menu and the Begin item. This will record the channel number of the marker and set the ROI status to Begin. Now move the marker to the other end of the region and use the ROI menu and the End item. This will set the ROI bit on all the channels between and including the two ends. The ROI status is turned to Off.

The ROI status is shown in the top of the screen on the right.

This command works on the MCB or the Buffer.

ROI <Alt R>

End <Alt E>

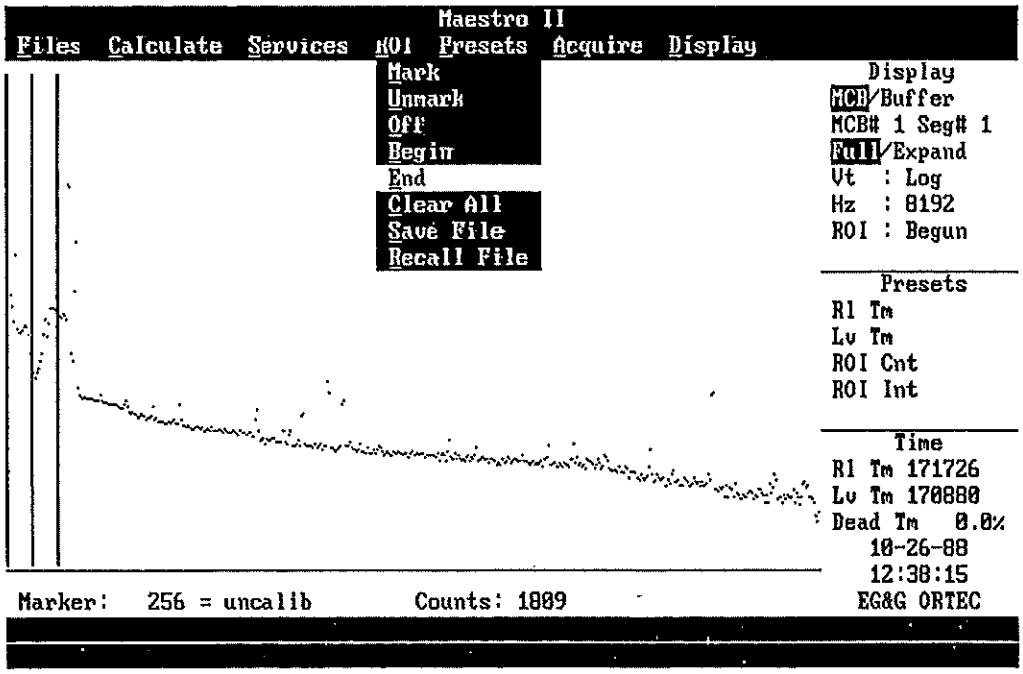


Figure 41. ROI End

This command sets the end channel when setting ROIs with Begin. It is used with Begin to set the ROI bits in the active MCB/Segment. If the ROI status is not Begin, this has no effect on the ROIs.

The ROI status is shown in the top of the screen on the right.

This command works on the MCB or the Buffer.

ROI <Alt R>

Clear All <Alt C>

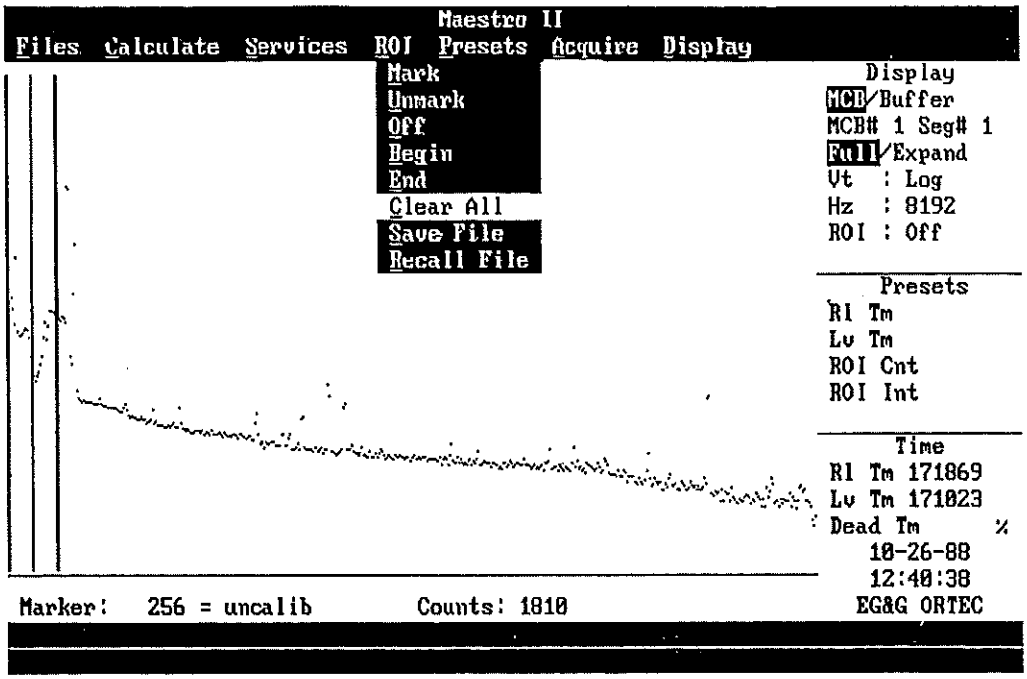


Figure 42. ROI Clear All

This command resets all the ROI bits in the active MCB/Segment. This does not affect the ROI status.

The ROI status is shown in the top of the screen on the right.

This command works on the MCB or the Buffer.

ROI < Alt R >

Save File < Alt S >

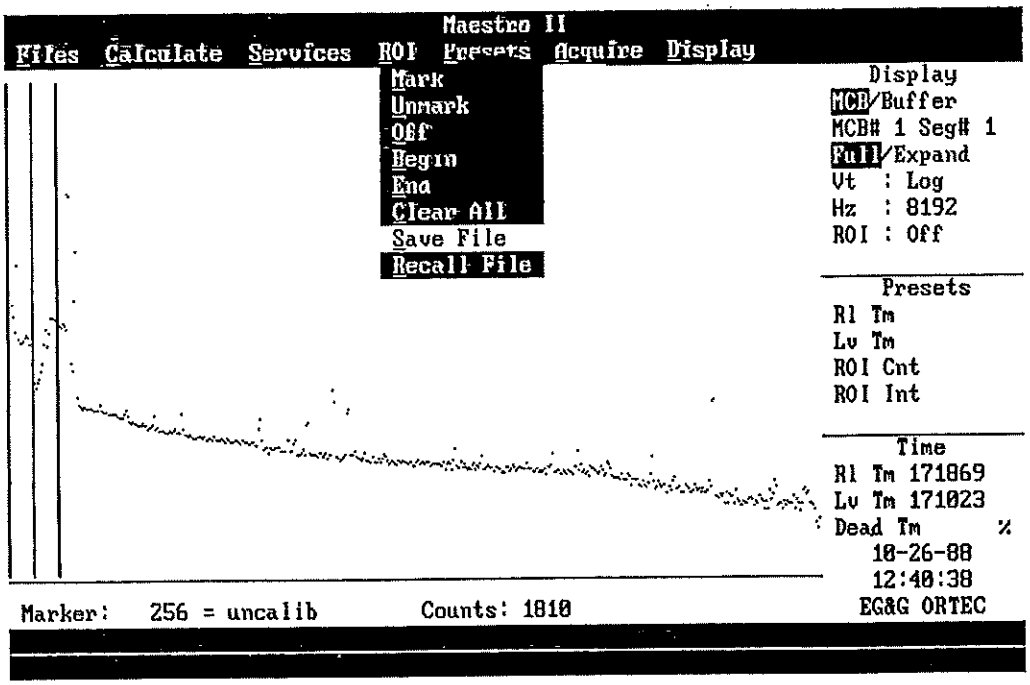


Figure 43. Save ROI Data File

This command saves a table of the channel numbers that have the ROI set in the Buffer, the active MCB/Segment, or all segments if the display is in FULL mode. The table is saved in a disk file. The contents of the spectrum are not altered. Any number of files can be saved.

After selecting the Save item, the user must enter the filename as in Figure 43. An invalid or null filename aborts the Save operation.

If the file exists, the warning in Figure 44 is shown and the user can enter new name or replace the old file with the new data. If replace is selected, the contents of the old file will be lost even if it was not a MAESTRO II ROI-type file.

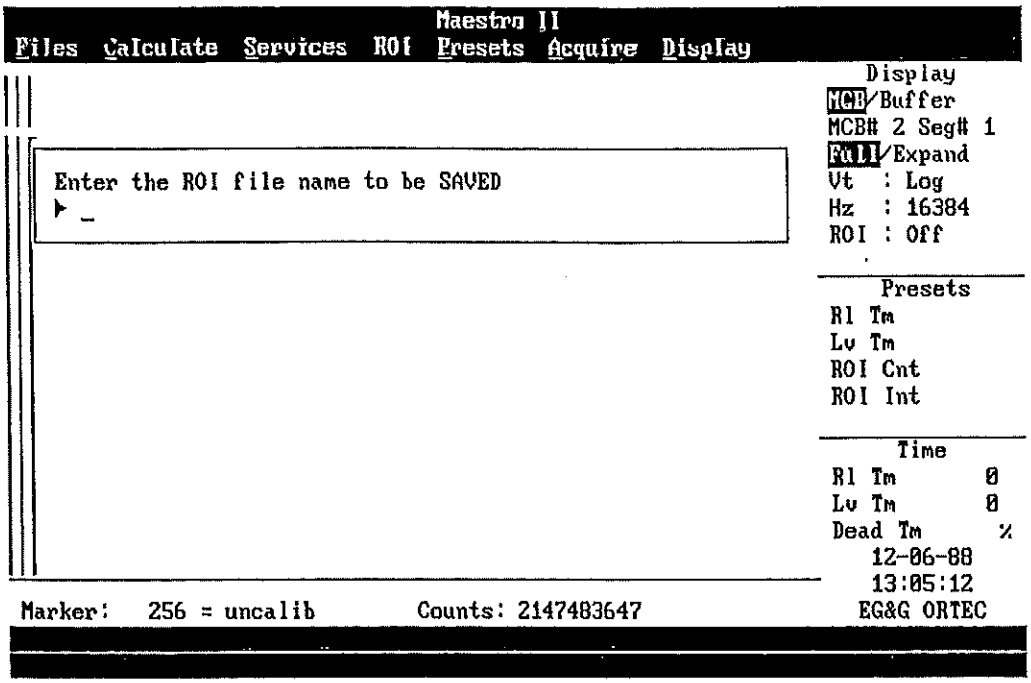


Figure 44. Save ROI Filename

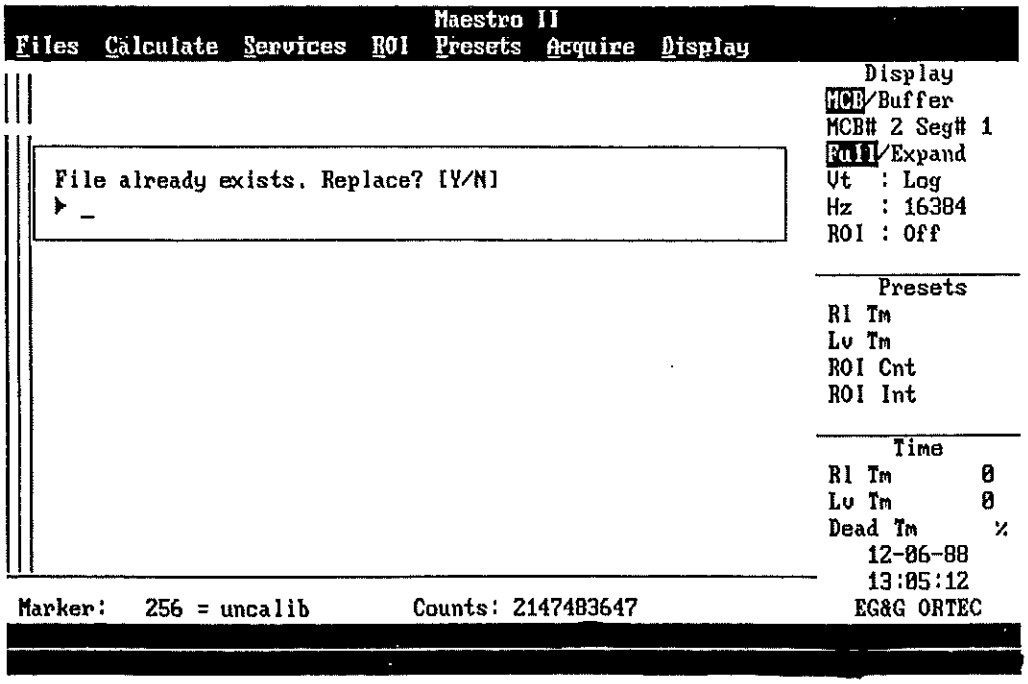


Figure 45. Save ROI Error

ROI < Alt R >

Recall File < Alt R >

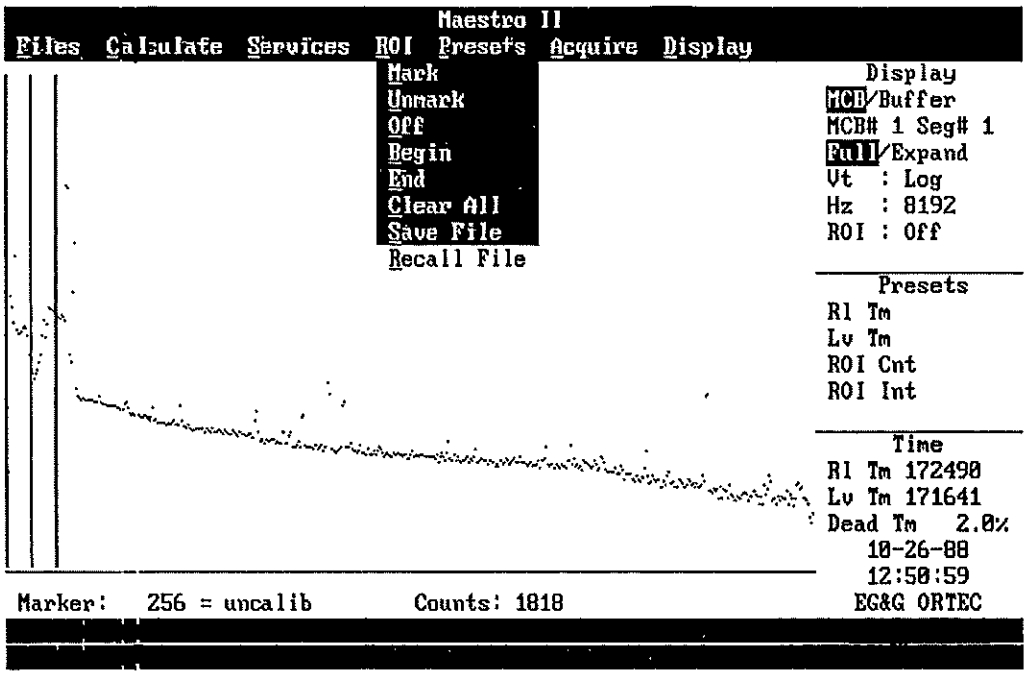


Figure 46. ROI File Recall

This command sets the ROIs in the Buffer or active MCB to conform to the table in the disk file created by ROI Save File (see above). The data contents of the MCB or Buffer are not altered by this operation. The previous ROIs in the Buffer or MCB are cleared.

Saving from the Buffer and recalling to the MCB is an easy way to transfer ROIs from the Buffer to the MCB.

The ROIs are saved by channel number, so if the spectrum peaks have shifted in position the ROIs in the file will not correspond exactly to the spectrum data.

If the ROI file is saved for a FULL display that is segmented, a recall in EXPANDED mode sets only the ROIs set for the active segment.

When this command is selected, a list of the ROI files in the default directory is displayed on the screen, see Figure 47. Use the <up arrow> and <down arrow> to select the desired file and <Enter> to load it. If a file not listed is desired (e.g., from another directory), enter the name at this time. At the first character entered, Figure 48 will be shown and the complete name followed by <Enter> is input.

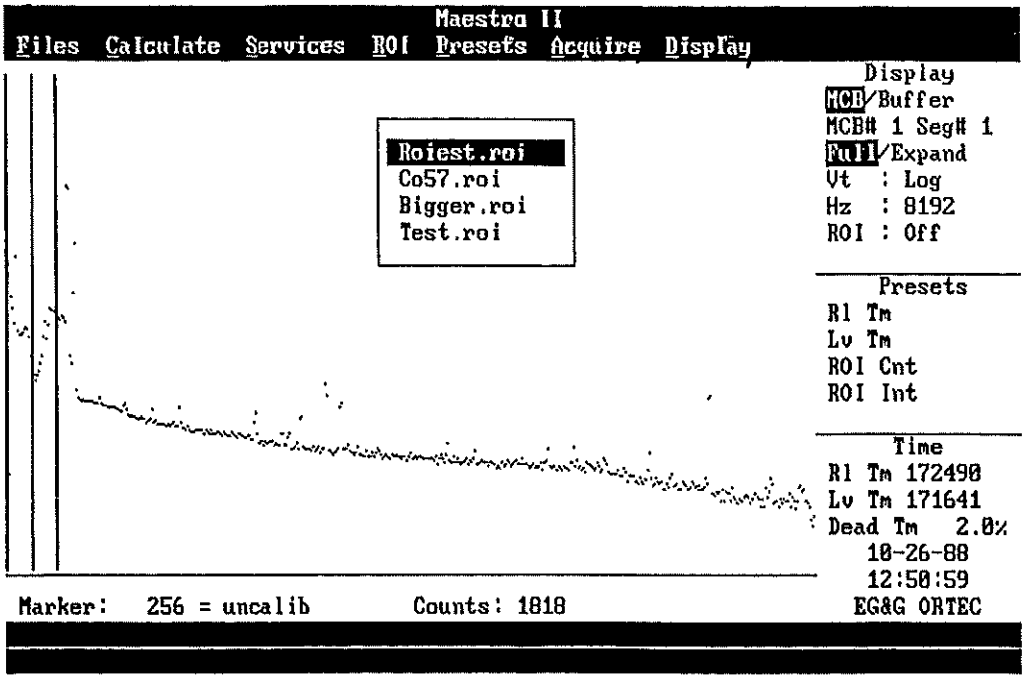


Figure 47. ROI Filename Section

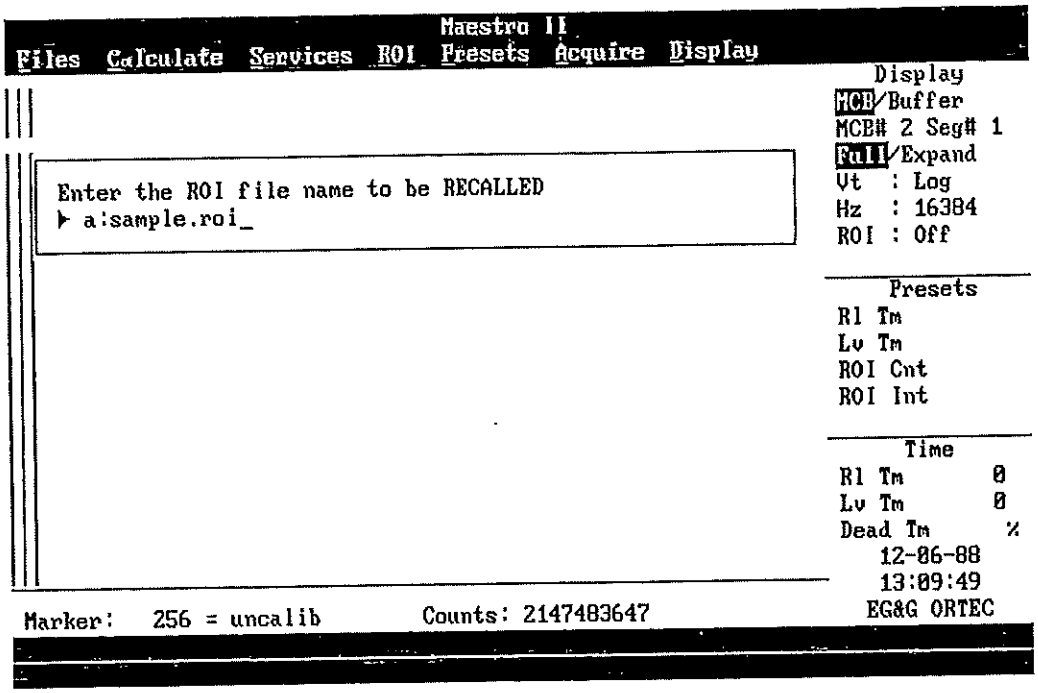


Figure 48. ROI Filename Entry

Calculate < Alt C >

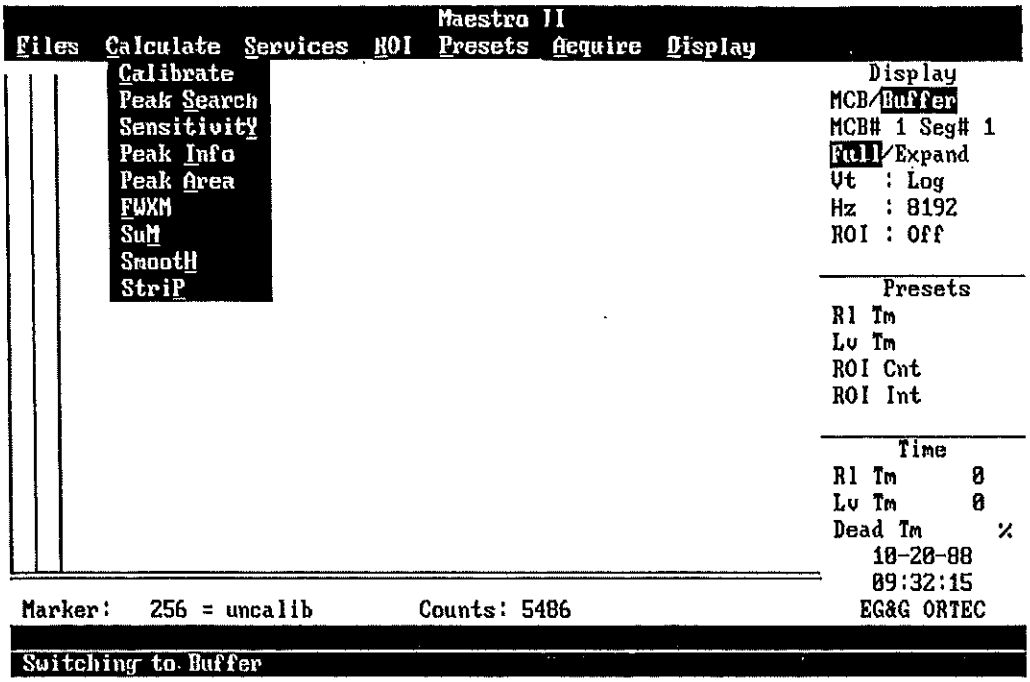


Figure 49. Calculate Menu

< Alt C > pulls down the Calculate menu. This menu is shown in Figure 49. If the display is showing an MCB, the spectrum display is switched to the Buffer. The calculate functions are only available for the Buffer.

When this menu is displayed, the screen display is not updated. Use the < Alt > and the underscored letter to perform the function or use the < up arrow > and < down arrow > to select the menu item and < Enter > to perform the action. The < left arrow > moves to the Files menu and the < right arrow > moves to the ROI menu. The < Esc > clears the menu without any action, redraws the spectrum display and returns to the monitoring mode.

Calculate <Alt C>

Calibrate <Alt C>

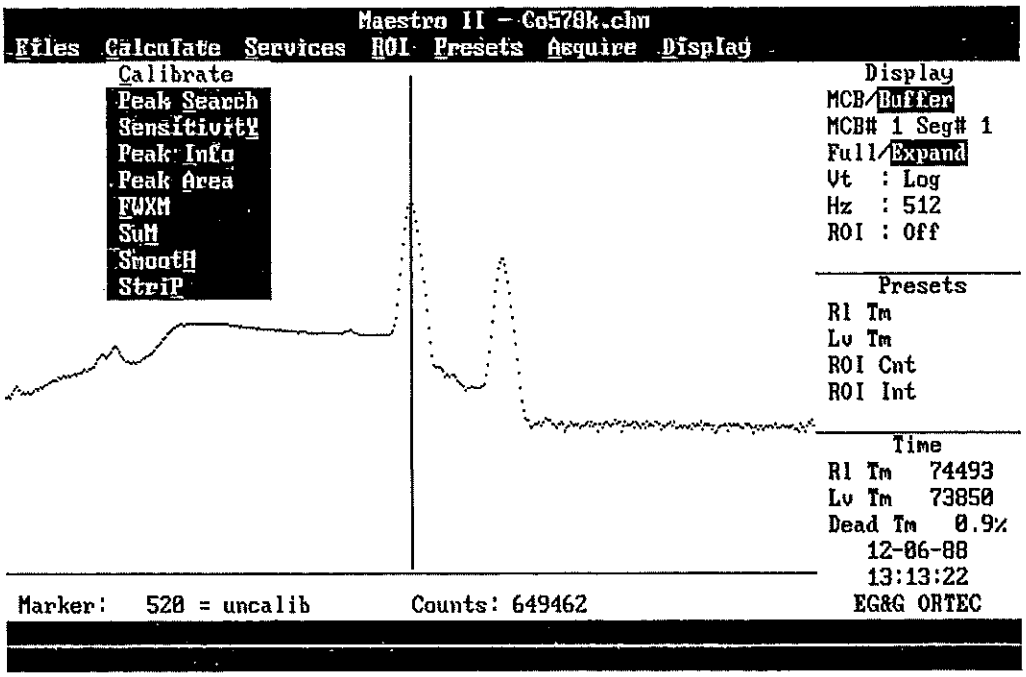


Figure 50. Calibration

This command is used to calibrate the system so that channel position and peak parameters are reported in the specified units as well as channels. The normal units are keV, but can be any units. The user enters the units so the display will show the desired values. The peak shape is measured and stored to be used in other functions such as ROI Insert. These values are stored with the spectrum when the Save function (see Files) is used. The calibration values are also saved in a disk file (in the default directory) that is read when the program is started so that the calibration is automatically restored.

If the active MCB/Segment and segmentation (number of segments) are the same as the Buffer MCB/Segment and the Buffer segmentation, then the calibration for the Buffer is automatically transferred to the MCB. Otherwise, the calibrations of the MCBs and Buffer remain separate. Each MCB can have separate calibration units.

The calibration is done by marking two well-separated clean peaks with ROIs and entering the energies for these peaks. Place the marker on one of the peaks. Use <Ins> to insert an ROI on the peak. Press <Alt C> to select the Calculate menu and <Alt C> again to select the marked peak and calculate the centroid of the peak. If the peak is good; that is, if it can be used in the calculation, then the program asks for the energy (in keV) of the peak. See Figure 51.

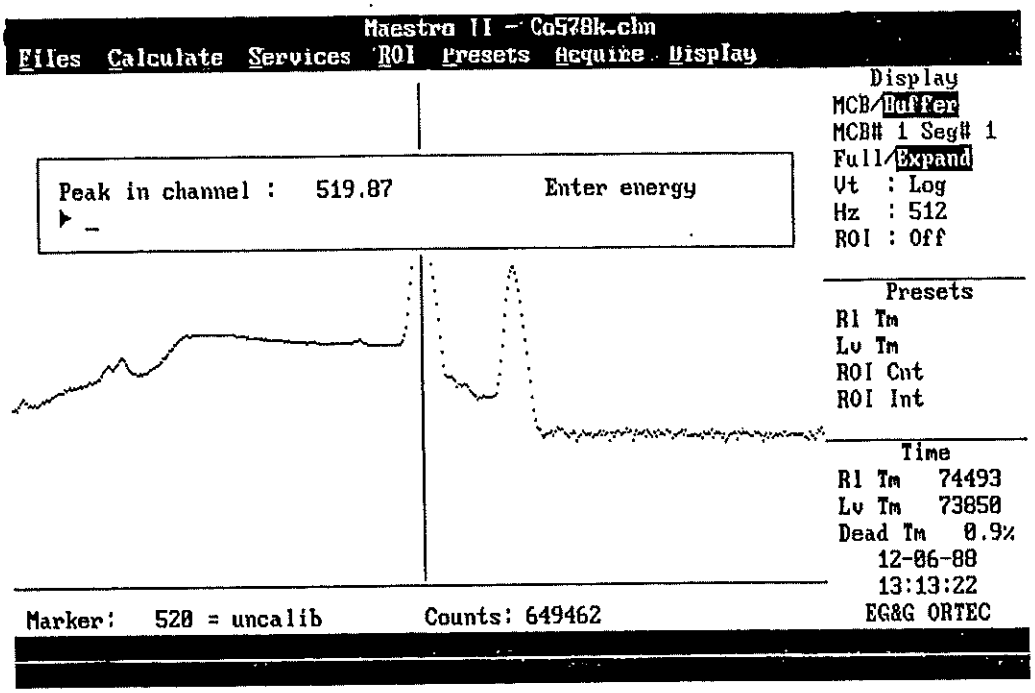


Figure 51. Calibration Value Input

Now move the marker to the second peak and repeat the process. After the second peak value is entered, the program asks for four characters for the units. See Figure 52. The system is now calibrated and the cursor location is shown in channels and the input units.

The calibration is automatically cancelled when Calibrate is selected when the Buffer is already calibrated.

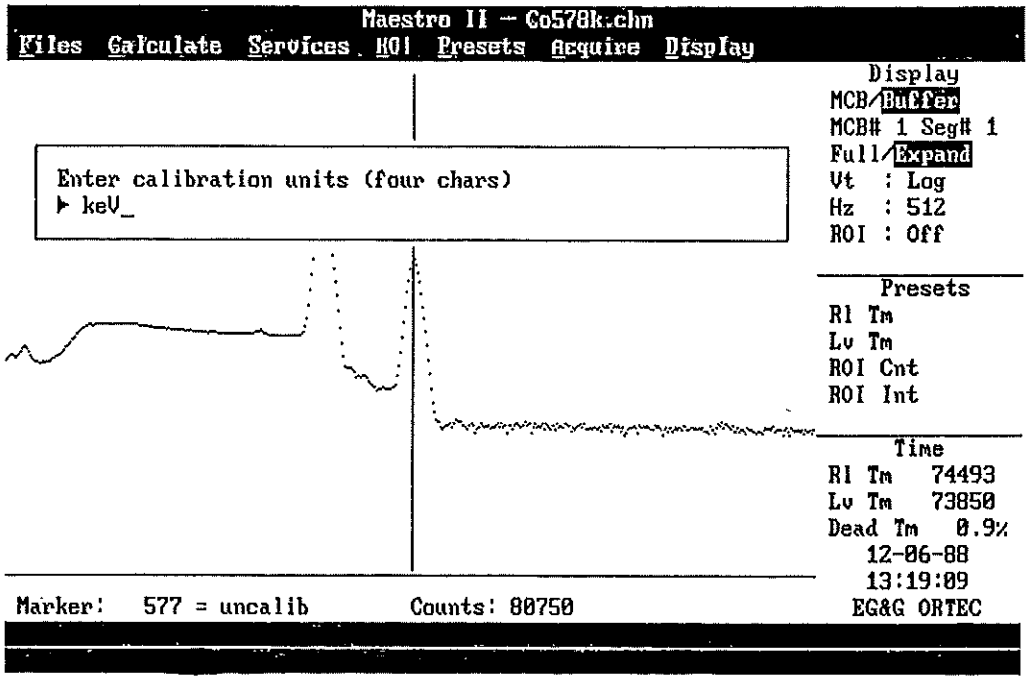


Figure 52. Calibration Units Input

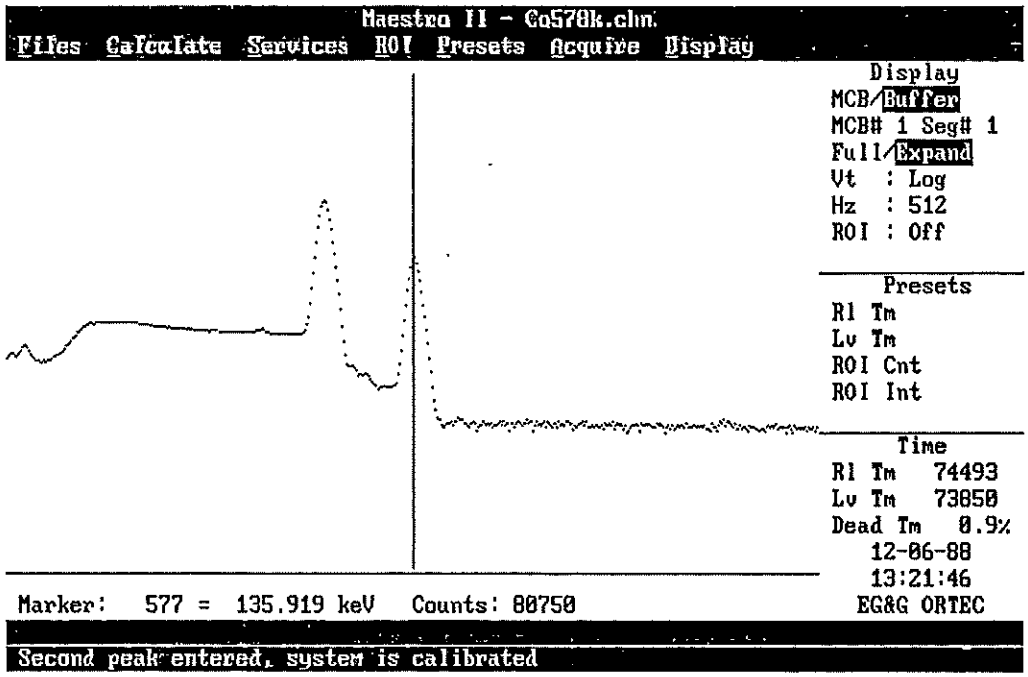


Figure 53. Finished Calibration

Calculate <Alt C>

Peak Search <Alt S>

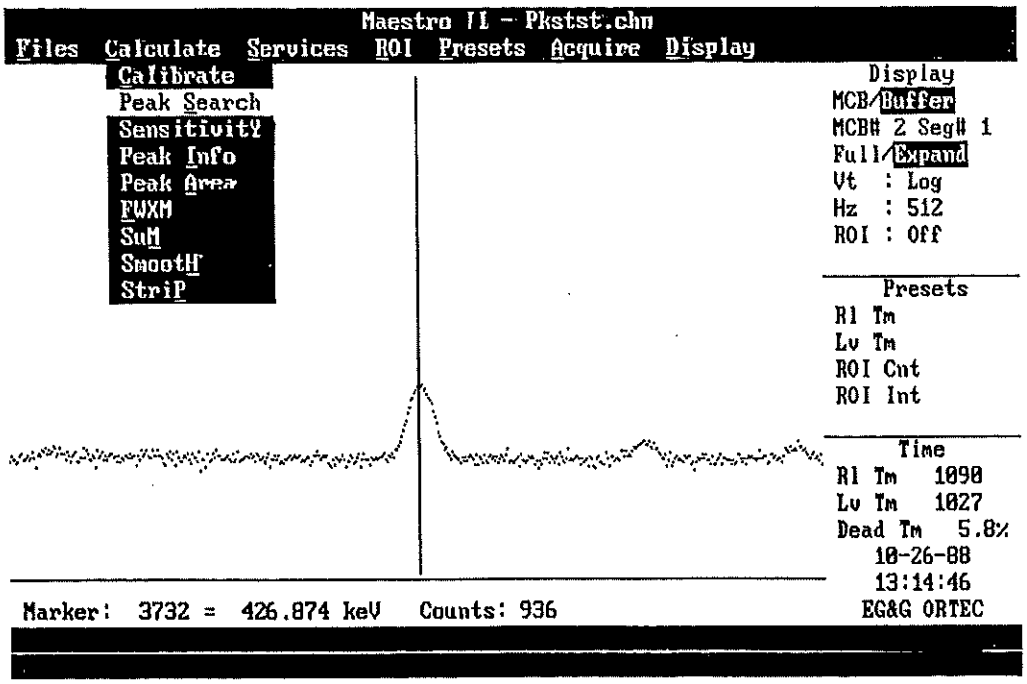


Figure 54. Peak Search

This command does a Mariscotti-type peak search on the spectrum in the Buffer. Only the active segment is searched. The Peak Search sensitivity is selected in the Sensitivity item of this menu. Each peak found is marked with a ROI. If the system is calibrated, the width of the ROI is three times the calculated FWHM of the peak. If not calibrated, the width of the ROI is based on the width of the peak as determined by the peak search.

Overlapping or close peaks may have contiguous ROIs.

Existing ROIs are not cleared.

The Report function (see Files) can be used with this function to produce a semi-quantitative nuclide list for the spectrum.

Calculate <Alt C>

Sensitivity <Alt Y>

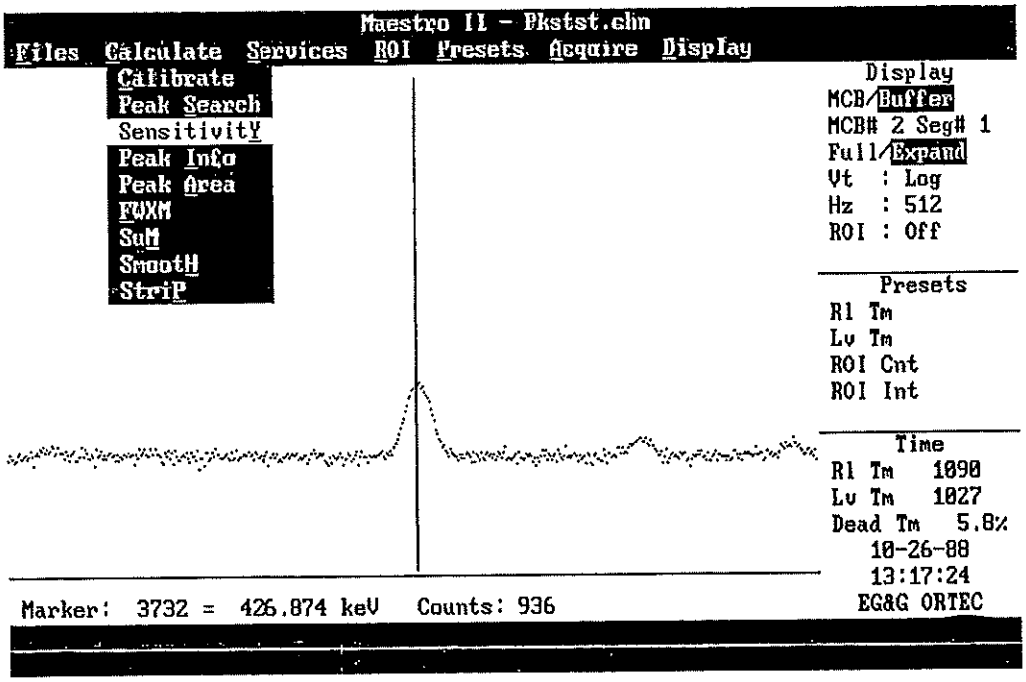


Figure 55. Peak Search Sensitivity

The Peak Search Sensitivity can be changed from 1 to 5 with 1 being the most sensitive; that is, 1 finds the most peaks.

The user can enter the integer value as shown in Figure 56. The current value is shown on the screen. A value of 1 will find small peaks, but will also find many false peaks. A value of 5 will locate all the big peaks, but may miss some of the smaller peaks. The middle value of 3 is a good choice to start with.

The suspected peaks must pass a sensitivity test to be accepted. This test compares the magnitude of the second difference with the weighted error of the channel counts. The second difference must be greater than the weighted error to be accepted. The input sensitivity is a multiplicative factor in the weighting factor.

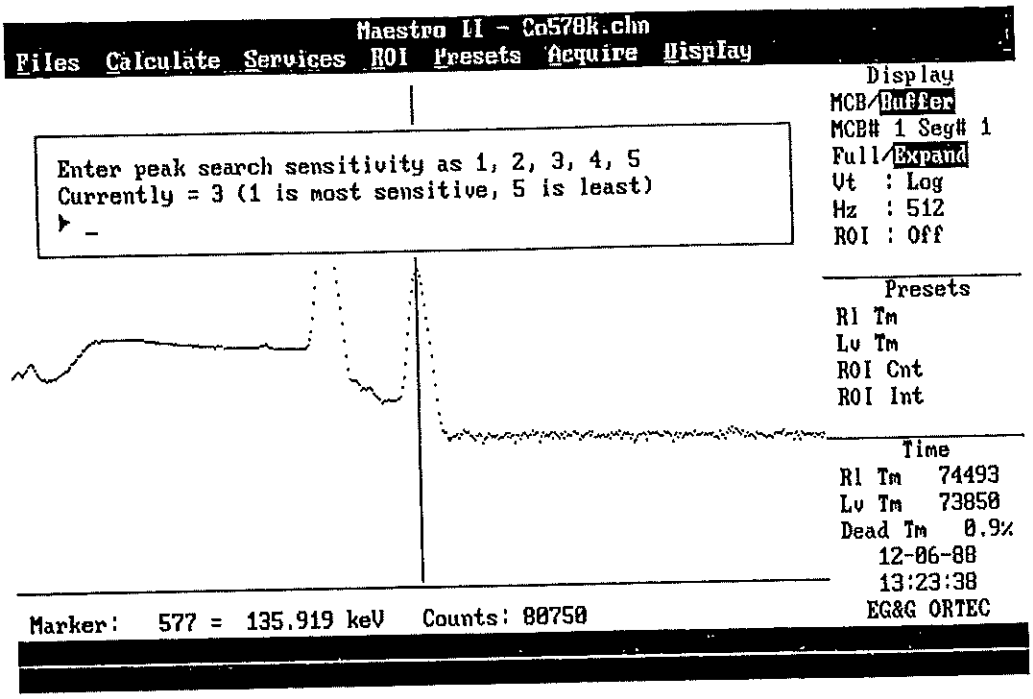


Figure 56. Sensitivity Input

Calculate <Alt C>

Peak Info <Alt I>

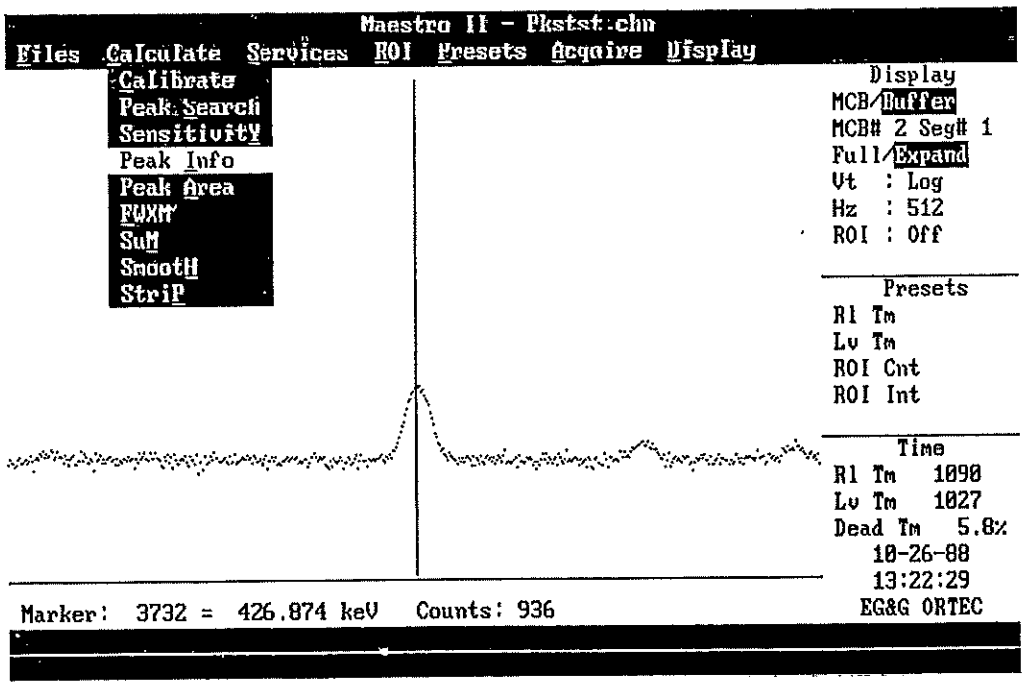


Figure 57. Peak Information

This command (see Figure 57) displays one of the following for the marker in an ROI:

1. If the spectrum is not calibrated, PKINFO displays the channel centroid, FWHM, FW.1M and FW.02M (in channels) for the ROI peak marked by the marker.

2. If calibrated, PKINFO displays the channel centroid and the FWHM, in channels and calibration units (e.g., energy), and the library "best match" for the ROI peak marked by the marker.

The program calculates the background using the average of the last three channels of the ROI on each side of the peak as end points of the straight-line fit. The background is calculated from the midpoint of the three points used in the average. See Figure 58.

The program subtracts the calculated background, channel by channel, and attempts a least-square fit of a Gaussian function to the remaining data. If unsuccessful, it displays "Could not properly fit the peak." If successful, the centroid is based on the fitted function. The reported widths are linearly interpolated between the background-subtracted channels.

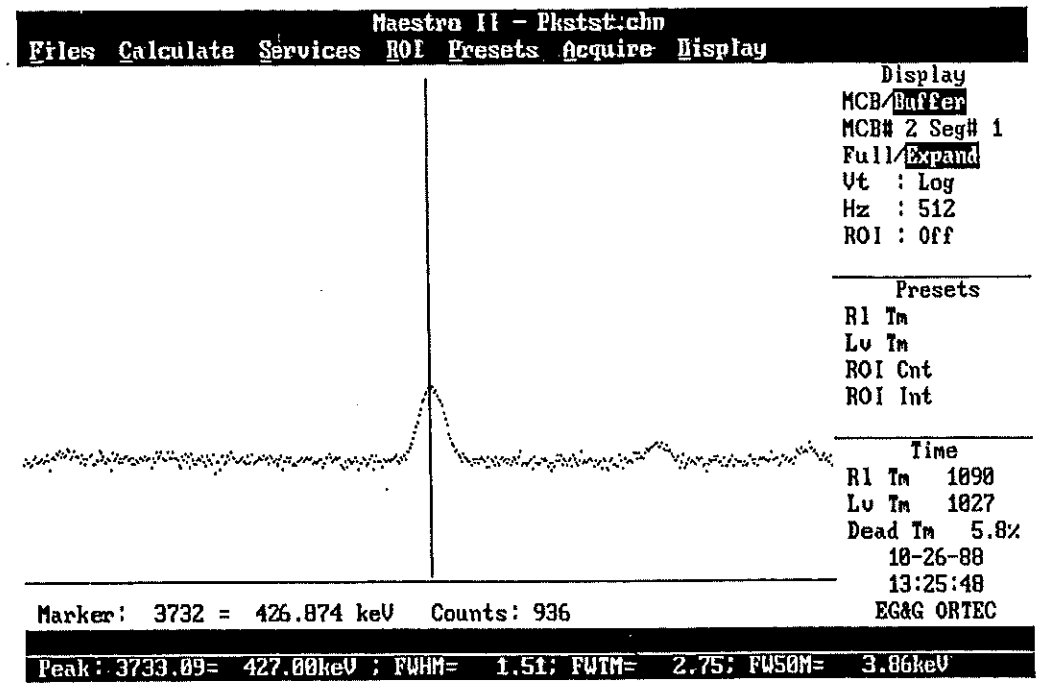


Figure 58. Peak Information Output

Calculate <Alt C>

Peak Area <Alt A>

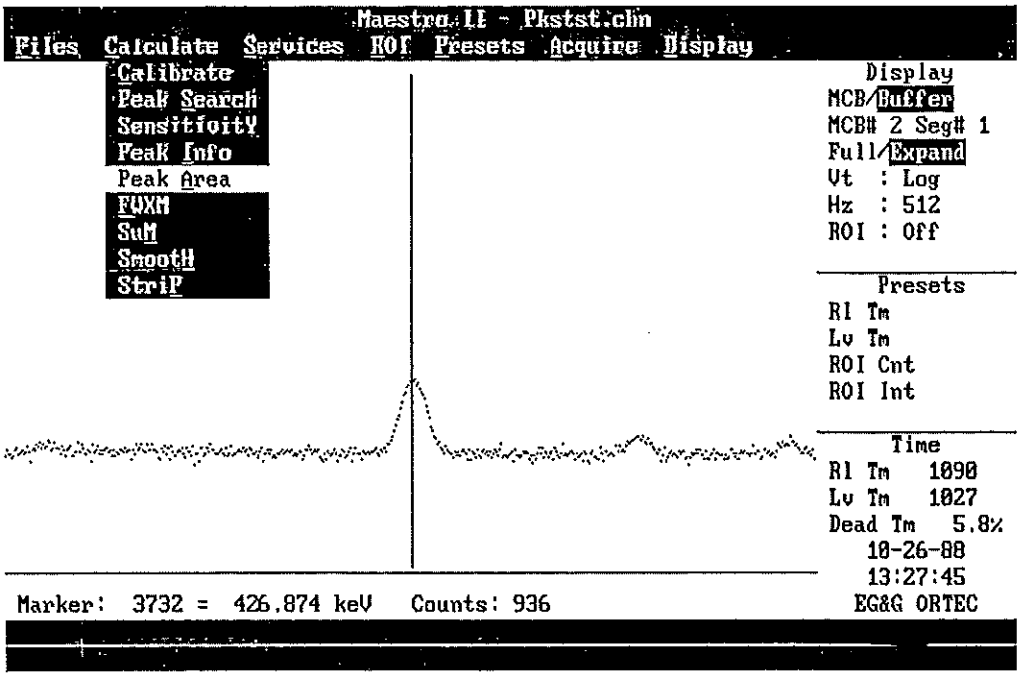


Figure 59. Peak Area

This command (see Figure 59) displays the net area, gross area, and the error of the net area for the ROI peak that is marked.

The background on the low channel side of the peak is the average of the first three channels of the ROI (see Figure 60). The channel number for this background point is the middle channel of the three points. The background on the high channel side of the peak is the average of the last three channels of the ROI. The channel number for this background point is also the middle channel of the three points. These two pairs of points on each side of the peak are the end points of the straight-line background.

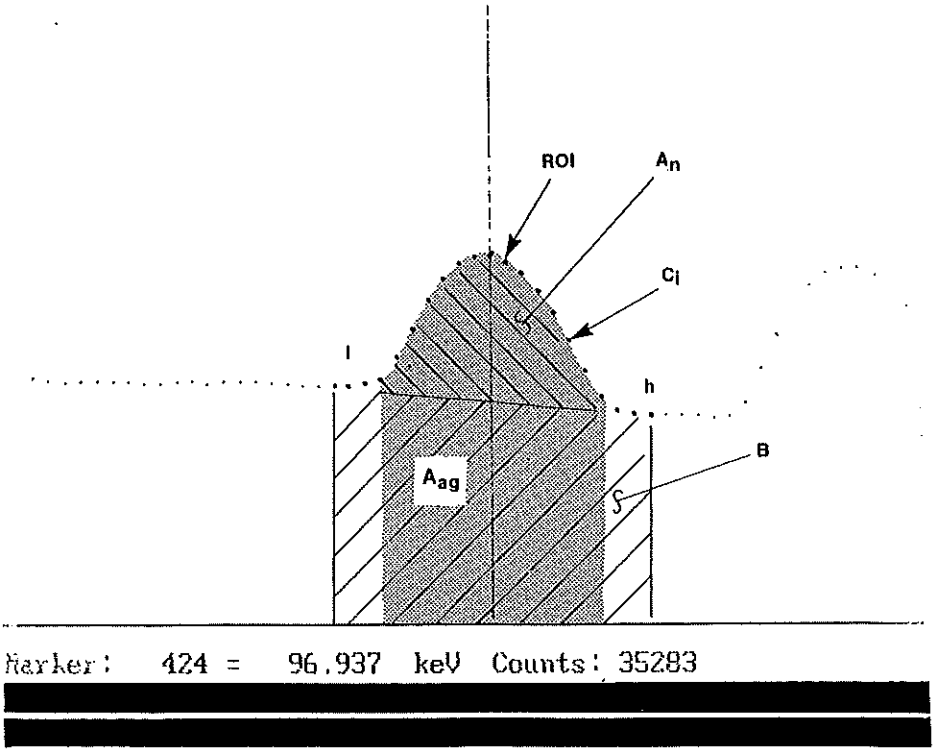


Figure 60. Background Calculation

The background is given by the following:

$$B = \left(\sum_{i=l}^{l+2} C_i + \sum_{i=h-2}^{h} C_i \right) \frac{h-l+1}{6}$$

where

B is	the background area
l is	the ROI low limit
h is	the ROI high limit
C_i is	the contents of channel i
6 is	the number of data channels used (3 on each end)

The gross area is the sum of all the channels marked by the ROI according to the following:

$$A_g = \sum_{i=l}^{h} C_i$$

where

A_g is	the gross counts in the ROI
l is	the ROI low limit
h is	the ROI high limit
C_i is	the contents of channel i

The adjusted gross area is the sum of all the channels marked by the ROI but not used in the background according to the following:

$$A_{ag} = \sum_{i=l+3}^{h-3} C_i$$

where

A_{ag} is	the adjusted gross counts in the ROI
l is	the ROI low limit
h is	the ROI high limit
C_i is	the contents of channel i

The net area is the adjusted gross area minus the adjusted calculated background, as follows:

$$A_n = A_{ag} - \frac{B^*(h-l-5)}{(h-l+1)}$$

The error in the net area is the square root of the sum of the squares of the errors in the adjusted gross area and the weighted error of the adjusted background. The background error is weighted by the ratio of the adjusted peak width to the number of channels used to calculate the adjusted background. Therefore, net peak area error is given by:

$$\sigma_{An} = \sqrt{A_{ag} + \left(\frac{h-l-5}{6}\right)\left(\frac{h-l-5}{h-l+1}\right)B}$$

where

A_{ag} is	the adjusted gross area
A_n is	the net area
B is	the background area
C_i is	the contents of channel i
l is	the ROI low limit
h is	the ROI high limit
σ_{An} is	the error in the net area

Calculate < Alt C >

FWXM < Alt F >

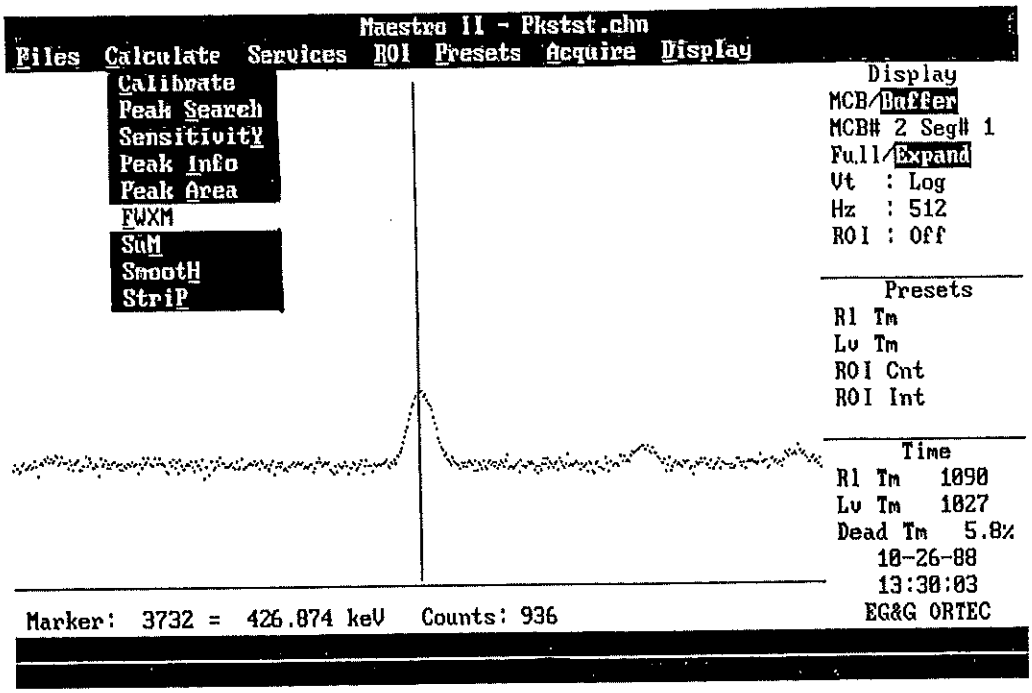


Figure 61. FWXM

This command (Figure 61) prints the full-width-X-maximum for the ROI peak marked by the cursor. The background is subtracted before the calculation (see Peak Info). The user enters the X factor, which is an integer from 1 to 999. The result is shown in channels, and, if calibrated, in the units entered in the calibration input.

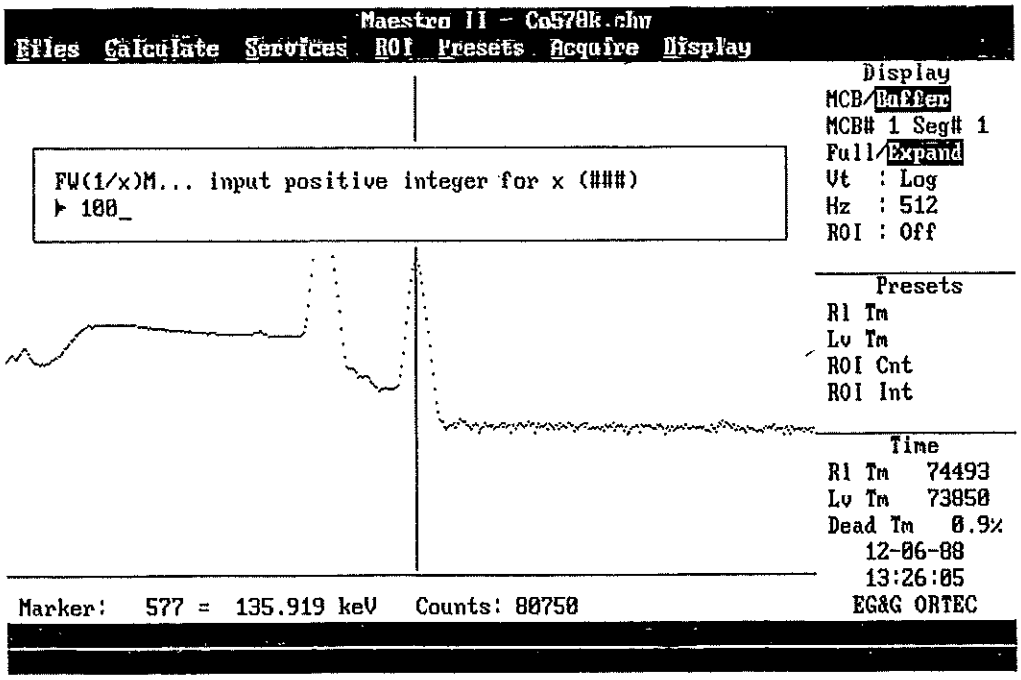


Figure 62. X-Factor for FWXM

Calculate <Alt C>

Sum <Alt M>

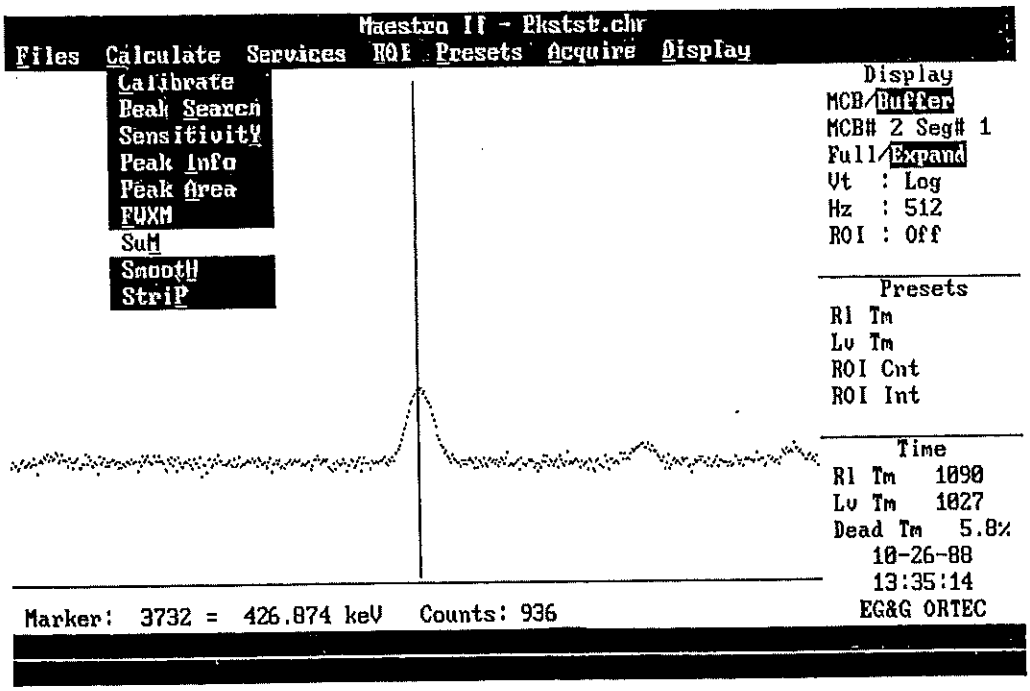


Figure 63. Spectrum Sum

This command operates in one of two modes, depending on the position of the marker:

1. If the marker is not in an ROI then the sum of the data channels of the Buffer segment is shown on the display. The complete channel width (e.g., 1 to 4096) is summed.

2. If the marker is in an ROI then the sum of the data channels in the ROI is shown on the display. This is the same as the gross counts in the Peak Area display, but can be used on wider ROIs.

Calculate <Alt C>

Smooth <Alt H>

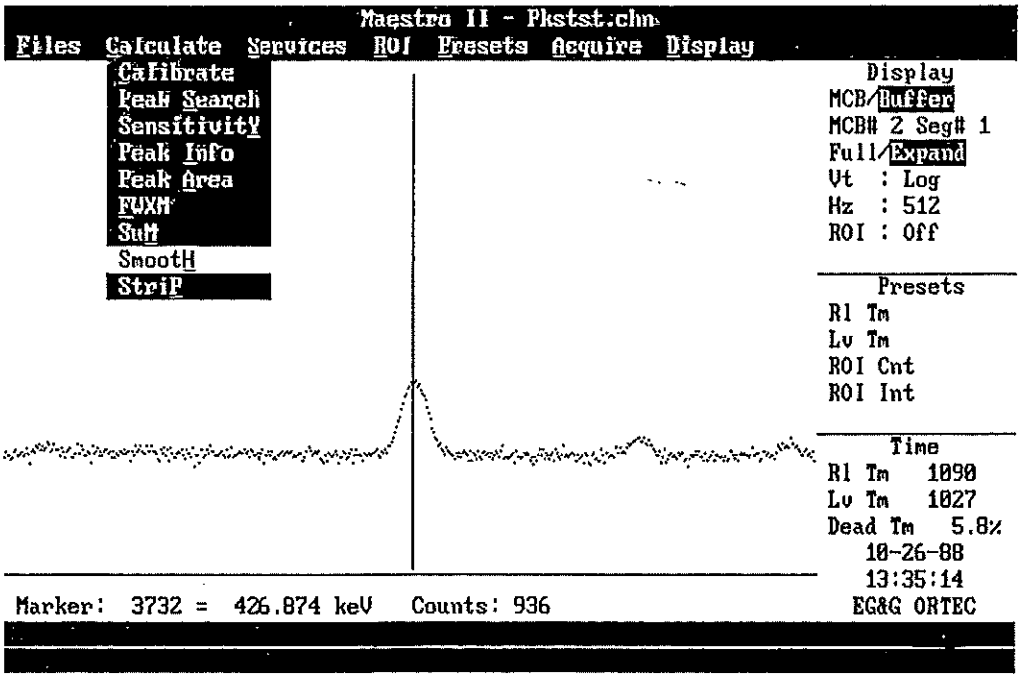


Figure 64. Spectrum Smooth

This command (Figure 64) smooths the data in the active segment in the Buffer. A five-point, area preserving, binomial smoothing algorithm is used. This replaces the existing data, channel-by-channel, with the averaged or smoothed data as follows:

$$S_i = \sum_{j=1}^{5} C_j * O_{i-3+j}$$

where

S_i is	smoothed data in channel i
O_i is	original data in channel i
C_j is	the j-th smoothing coefficient

Calculate <Alt C>

Strip <Alt P>

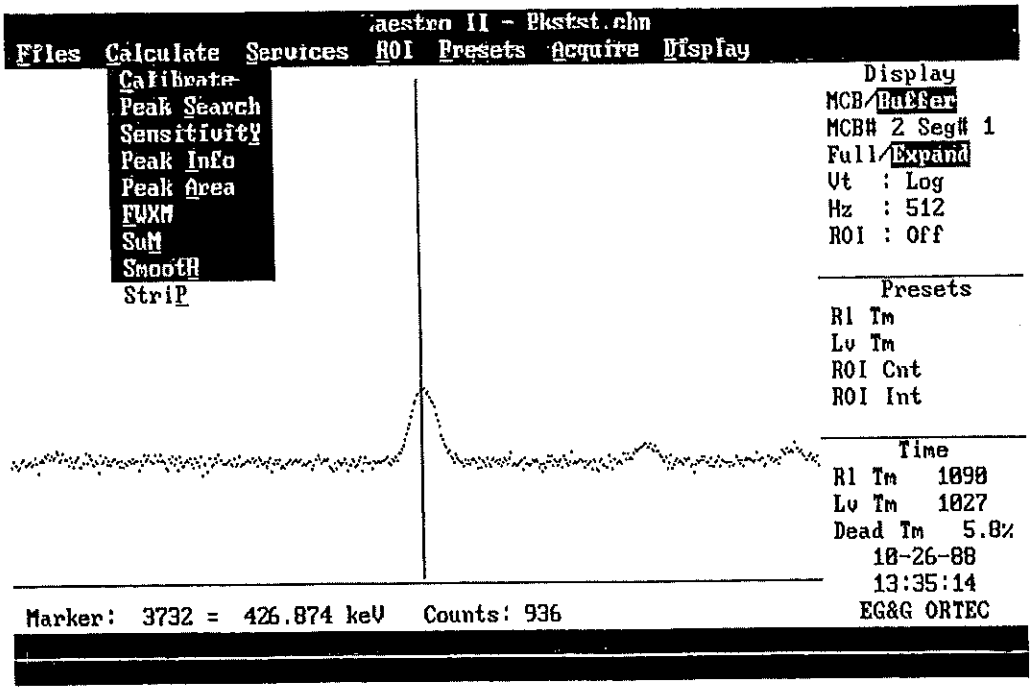


Figure 65. Spectrum Strip

This command strips a specified disk spectrum from the spectrum in the Buffer and stores the result in the Buffer. The disk and Buffer spectra must be the same size. The disk spectrum can be scaled up or down by a user-input constant or by the ratio of the livetimes of the two spectra. If the scaling constant is negative, the disk spectrum is added to the Buffer spectrum.

When the Strip function is selected, a list of spectra on the disk (in the default directory) will be displayed on the screen. See Figure 66. Use <up arrow> and <down arrow> to select the desired spectrum and <Enter> to process it. Only 11 spectrum names are shown at one time. To view more spectra, use <down arrow> to move the list up the screen. The <up arrow> will move the list down the screen.

If there are no spectra on the disk, the Enter Name screen (Figure 67) is displayed. If the spectrum desired is not shown on the list of spectra, enter

the first character of the filename and the Enter Name screen will be displayed. Any DOS filename can be entered.

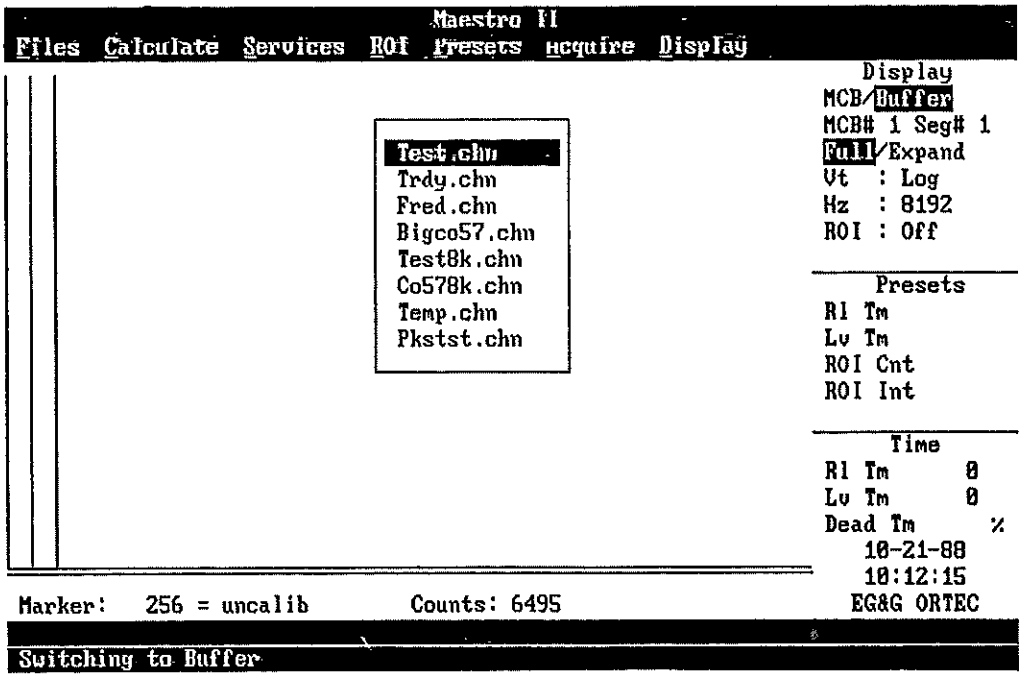


Figure 66. Spectrum Strip; List of Files

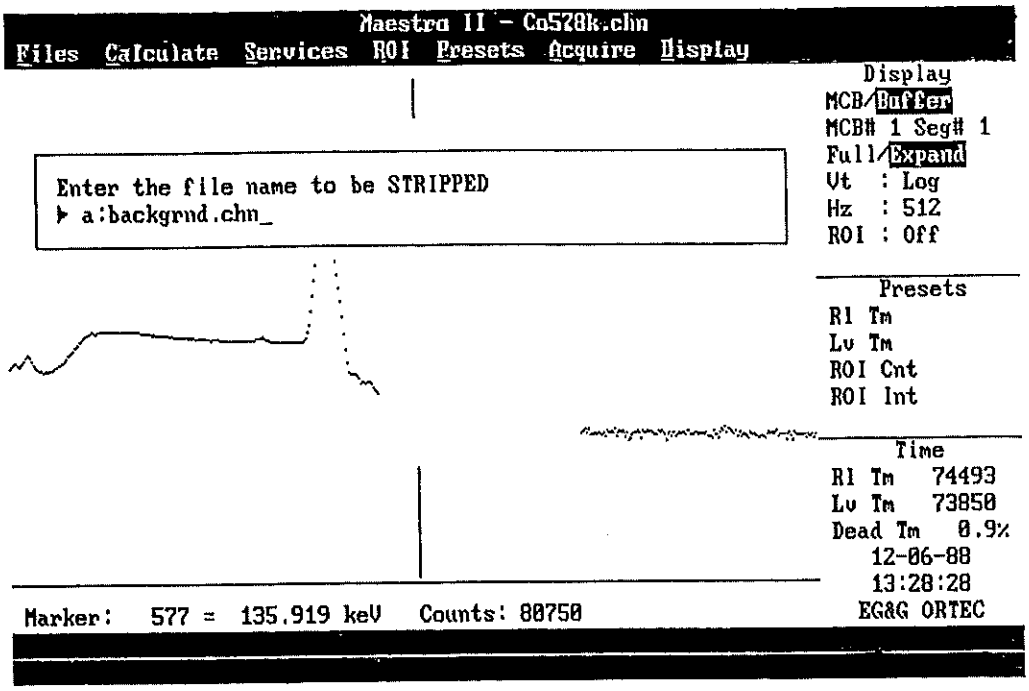


Figure 67. Spectrum Strip; Filename Entry

The <Esc> or any invalid filename will abort the strip operation without altering the Buffer spectrum.

After the filename has been accepted, the strip factor is requested. See Figure 68.

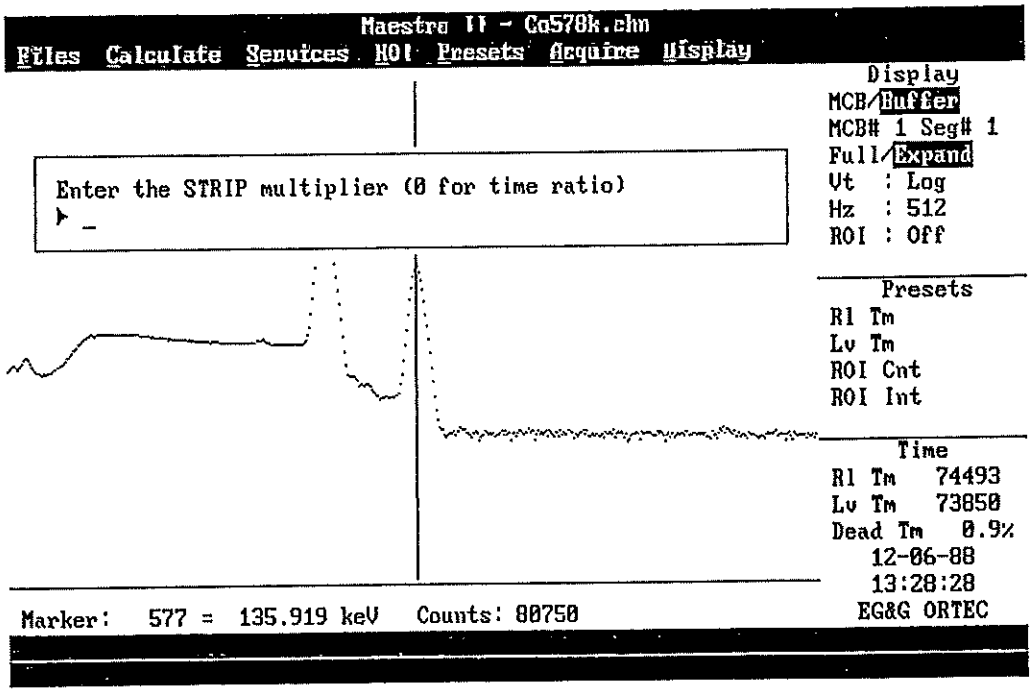


Figure 68. Spectrum Strip; Strip Factor

The strip factor is a real number (e.g., 2.3E-1) that is multiplied channel-by-channel times the disk spectrum before the channels are added together. If the strip factor is entered as 0, the strip factor is calculated as the ratio of the livetimes of the two spectra. The factor is the livetime of the Buffer spectrum divided by the livetime of the disk spectrum.

If the strip factor is negative (e.g., -1) the disk spectrum (or fraction) is added to the Buffer spectrum.

The livetimes and realtimes are not altered by any strip operation. The peak errors (see Calculate, Peak Area) will not include the stripped areas and may not represent the true error.

If an error occurs, (i.e., bad filename, spectra of different sizes) then a message is displayed and the operation stops.

Files <Alt F>

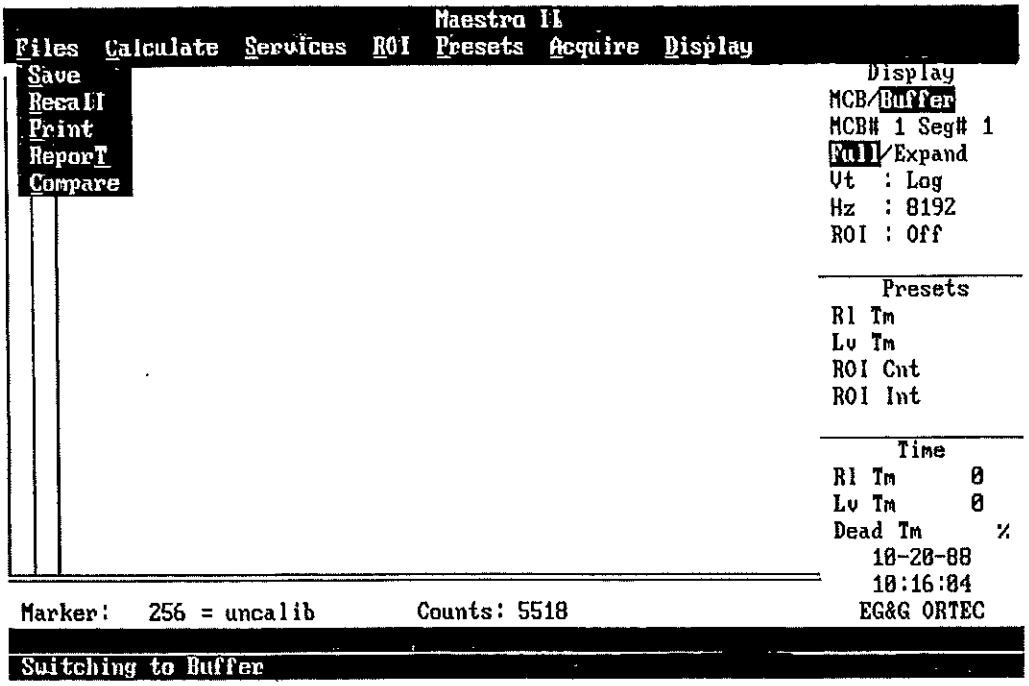


Figure 69. Files Menu

The <Alt F> pulls down the Files menu. This menu is shown in Figure 69. If the display is showing an MCB, the spectrum display is switched to the Buffer. The Files functions are only available for the Buffer.

When this menu is displayed the screen display is not updated. Use the <Alt> and the underscored letter to perform the function or use the <up arrow> and <down arrow> to select the menu item and <Enter> to perform the action. The <left arrow> moves to the Display menu and the <right arrow> moves to the Calculate menu. The <Esc> clears the menu without any action, redraws the spectrum display and returns to the monitoring mode.

Files <Alt F>

Save <Alt S>

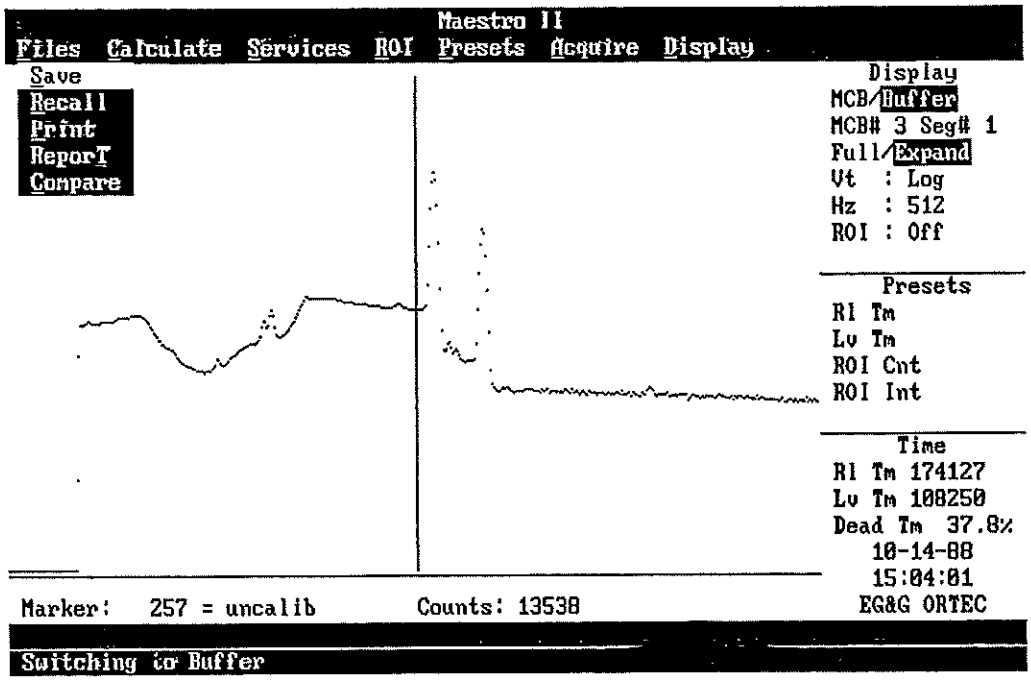


Figure 70. Save Spectrum on Disk

This command Saves the active segment in the Buffer, as shown in the upper right-hand corner, to disk. The program asks for a filename which can have up to eight characters. The default extension is CHN. Any valid DOS name can be used. The following are stored with the data: livetime, realtime, time acquisition begins, and the detector and sample descriptions. If calibrated, the calibration information is stored. The file structure is shown in the File Structure manual.

In a segmented system, each segment is saved in a separate file. The Save command must be given once for each segment to be saved.

After the Save item has been selected, the filename to be used is requested (see Figure 71). If this filename is already being used, the user is asked whether or not to overwrite the old file or enter another name (see Figure 72).

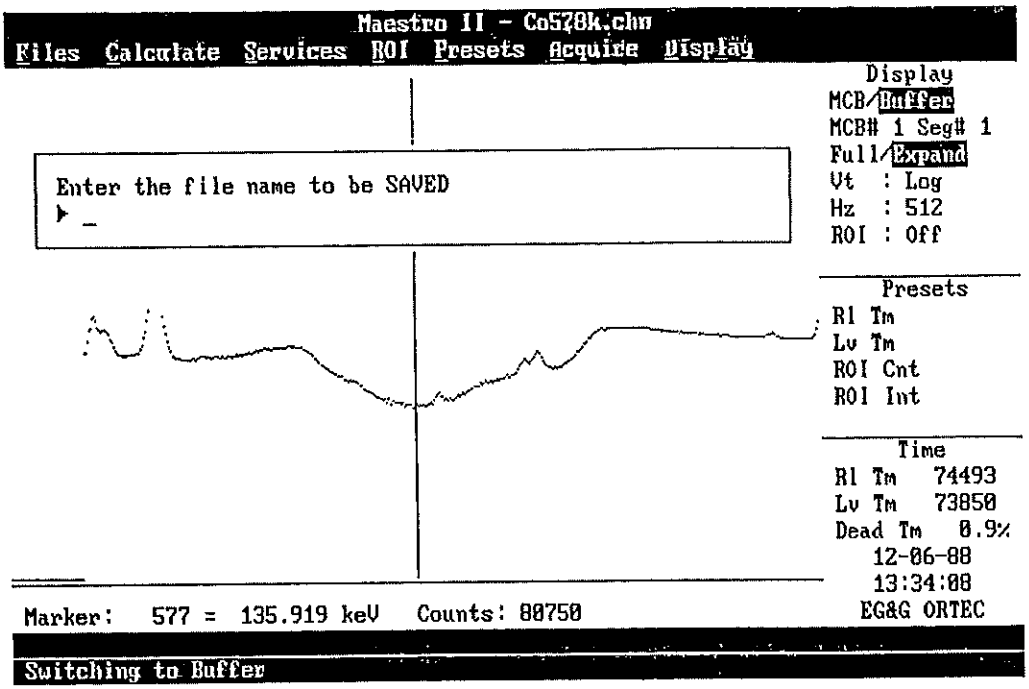


Figure 71. Saved Spectrum Filename

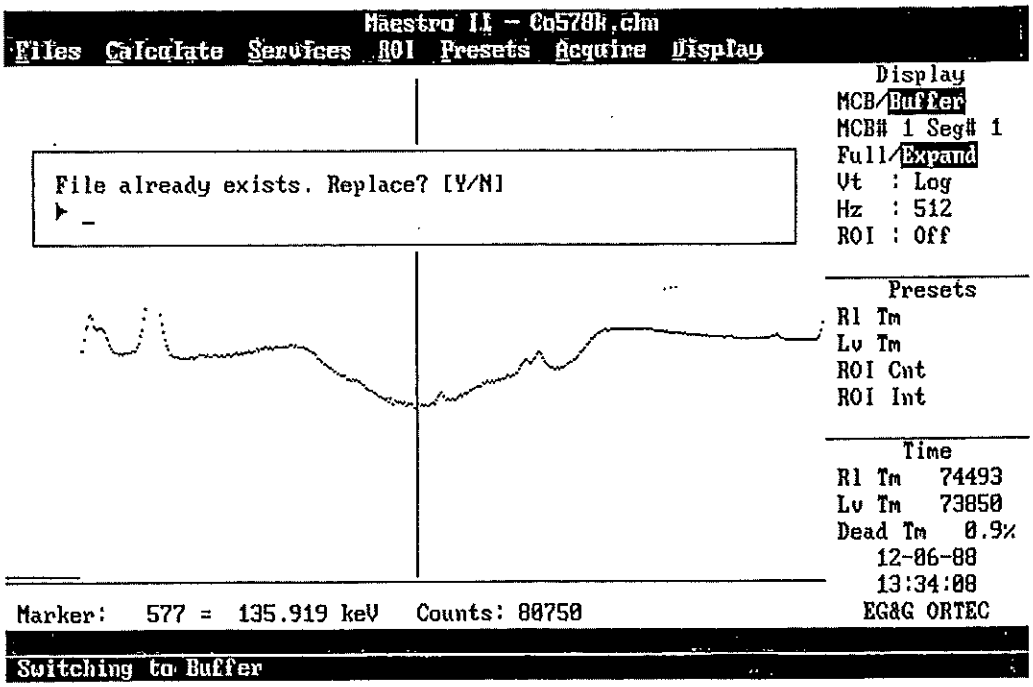


Figure 72. Filename Duplication, Overwrite?

After the filename has been sucessfully entered, the sample description is requested. See Figure 73. Any 60-character description can be entered. It is saved with the spectrum on disk and is written out by the Report function and other analysis programs, such as MINIGAM II and GELIGAM II.

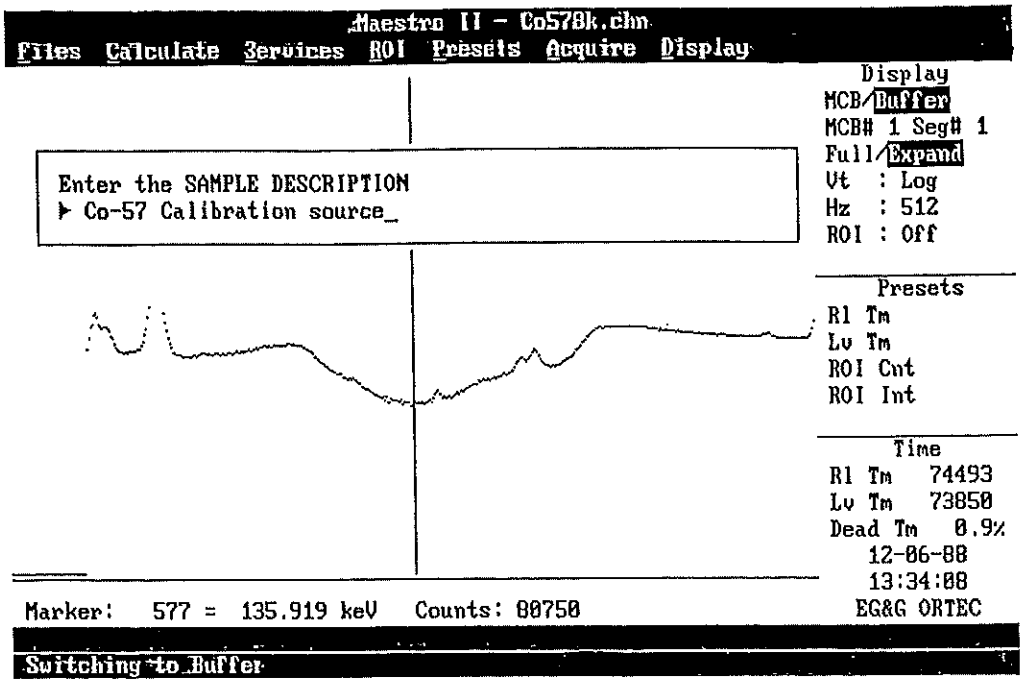


Figure 73. Spectrum Sample Description

After the disk file has been written, the filename is displayed on the upper right side of the MAESTRO II line at the top of the screen.

Files <Alt F>

Recall <Alt R>

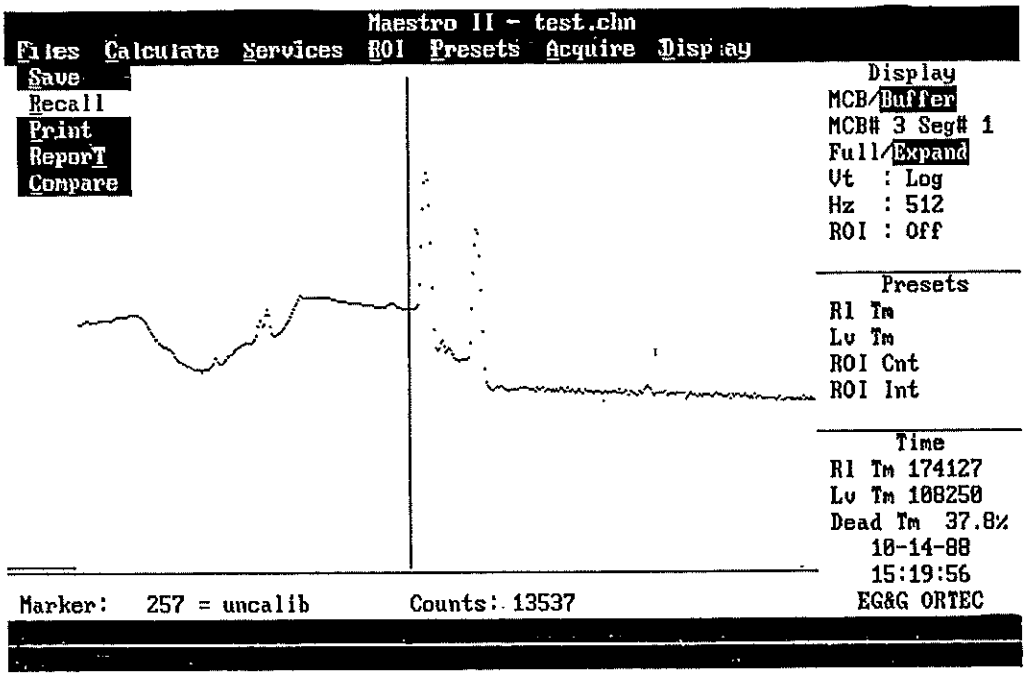


Figure 74. Spectrum Recall

This command reads a disk file created by Save or other programs (e.g., A48-BI). The file is read into the Buffer area. At this time the Buffer is resized to conform to the memory size and segmentation of the recalled spectrum. The program restores the file to the proper segment. The livetime and realtime are also restored. In FULL mode, the unused segments are set to zero; therefore, to replace one segment, only that segment should be displayed.

When the Recall function is selected, a list of spectra on the disk (in the default directory) will be displayed on the screen. See Figure 75. Use <up arrow> and <down arrow> to select the desired spectrum and <Enter> to process it. Only 11 spectrum names are shown at one time. To view more spectra, use <down arrow> to move the list up the screen. The <up arrow> will move the list down the screen.

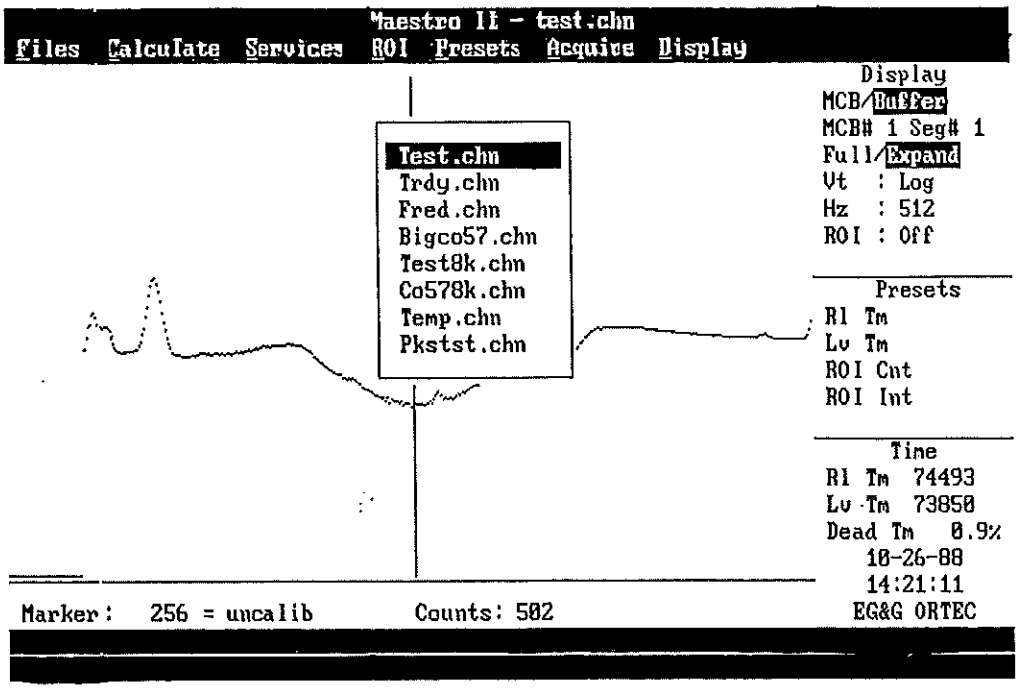


Figure 75. Spectrum Recall File List

If there are no spectra on the disk, the Enter Name screen (Figure 76) is displayed. If the spectrum desired is not shown on the list of spectra, enter the first character of the filename and the Enter Name screen will be displayed. Any DOS filename, including the drive and subdirectory name, can be entered.

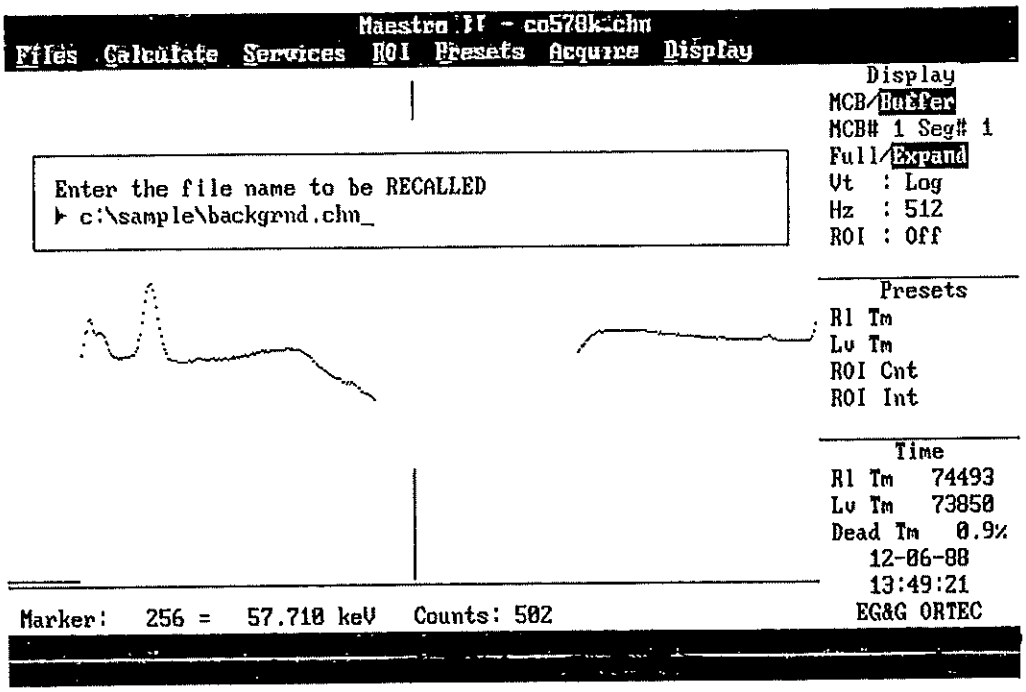


Figure 76. Spectrum Recall Filename Entry

Saving and recalling a null or an all-zero spectrum is an easy way to erase the Buffer.

If the spectrum file has calibration information, then these calibration parameters are used to set the calibration for the Buffer.

When the spectrum has been recalled, the filename is displayed on the upper right side of the MAESTRO II line at the top of the screen.

Files <Alt F>

Print <Alt P>

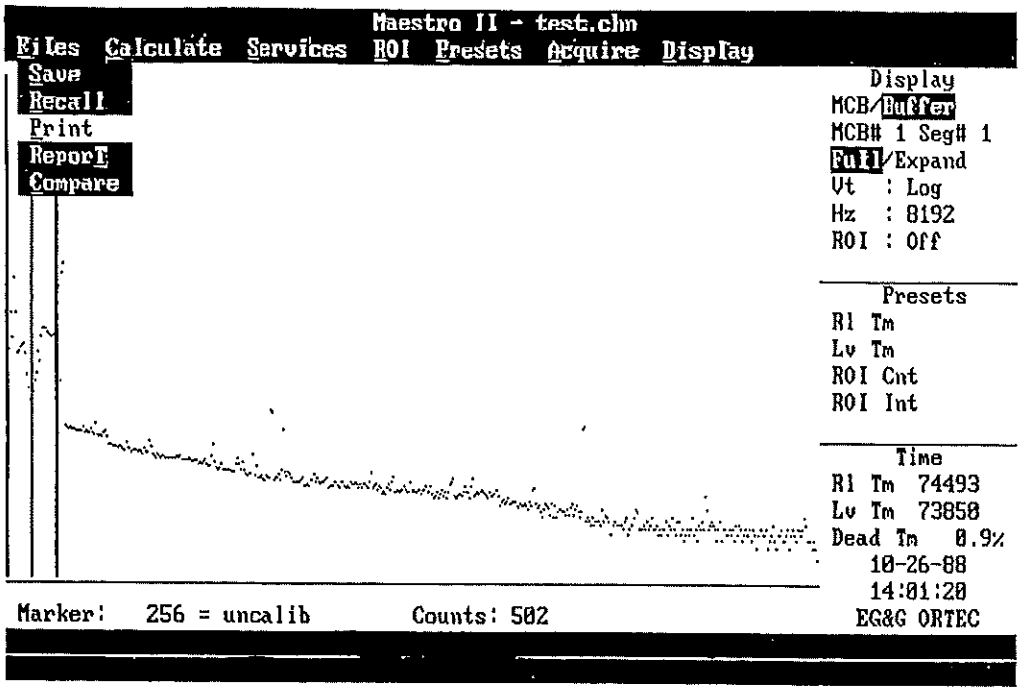


Figure 77. Print Spectrum Data

This command does one of the following:

1. If the display is in FULL mode, the entire Buffer is printed.

2. If the display is in EXPAND mode and the marker is in an ROI, the data contents of the ROI channels are printed.

3. If the display is in EXPAND mode and the marker is not in an ROI, the active segment is printed.

The printout is automatically sent to the printer. The data are formatted as 10 channels per line with the channel number on the left. This requires a 132-column line printer. The MODE LPT1: 132 command (see DOS manual) is needed for the 80 column IBM printer.

The <Esc> stops the printing at the end of the line. This may not stop printing until the printer internal Buffer is empty.

Files <Alt F>

Report <Alt T>

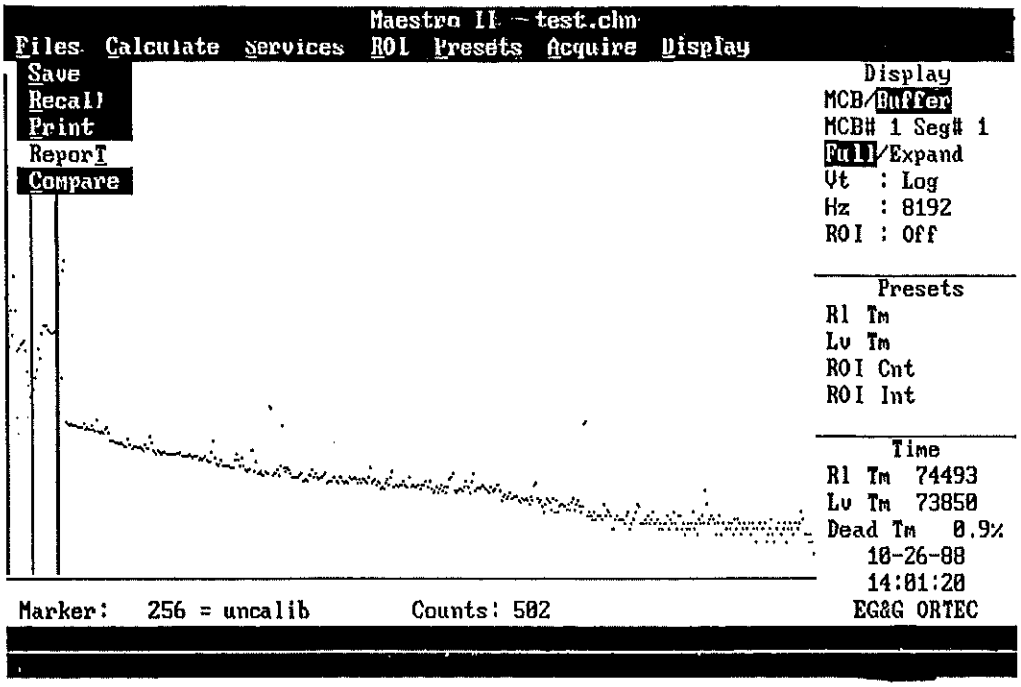


Figure 78. Spectrum Report

This command prints the sample and detector descriptions, the MCA number, realtime and livetime, the date, and information for each ROI in the active segment of the Buffer.

If the spectrum is not calibrated, Report prints the following:

1. ROI number and segment number (1 is lowest in the segment)
2. Start channel of the ROI
3. Stop channel of the ROI
4. Gross area of the peak
5. Net area of the peak, as calculated in Calculate, Peak Area
6. Error in net area, as calculated in Calculate, Peak Area
7. Centroid channel of peak, as calculated in Calculate, Peak Area
8. FWHM
9. FW.1M

If the spectrum is calibrated, Report prints the following:

1.- 9. All the above values in both energy and channel
10. The best match from the library

If a match is found in the library, Report prints the following:

11. The corrected net count rate using the net area, the livetime and the factor from the library

The user can enter the output device (see Figure 79). The output (see Figure 78) can be printed on the printer (PRN), or sent to a disk file. The disk file can be used by other programs or printed later. If CON is selected for the output, the MCA display is displaced by the report. To return to the MCA display, press <Alt S>, <Alt E> which clears the screen and goes to DOS, then type "exit" <Enter> to return to the MAESTRO II program.

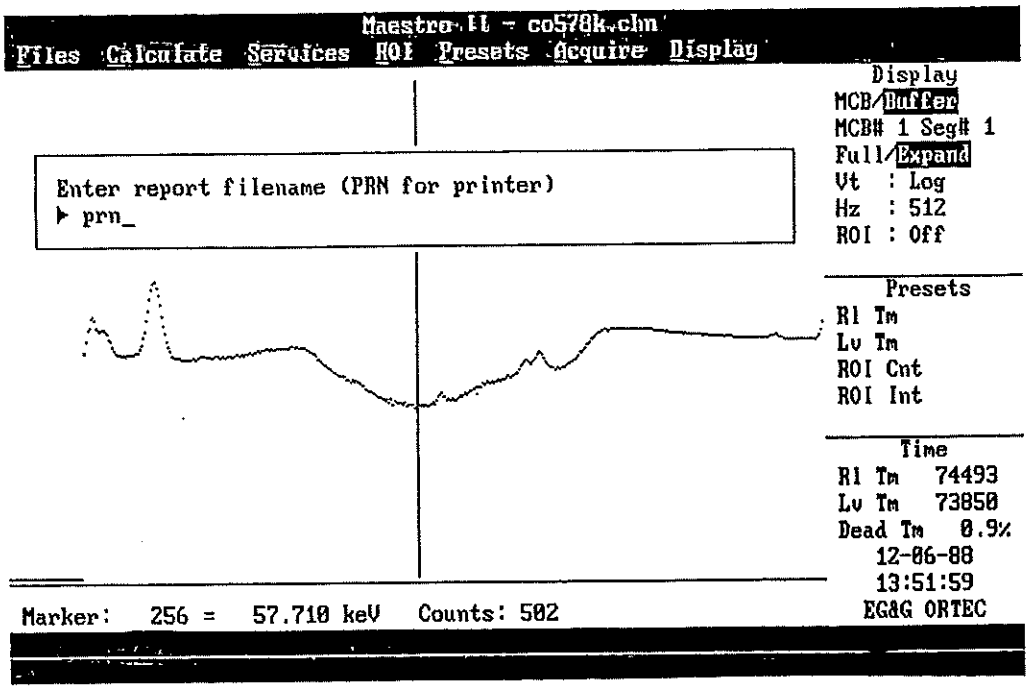


Figure 79. Spectrum Report Output Name

```
MCB # 1       ACQ 09-22-88  AT 12:40:17   RT : 74494.0    LT : 73850.1
              No detector description was entered
              Co-57 Calibration source

ROI #  1-1    RANGE :   78 =   14.34keV  to  104 =   20.68keV
              AREA : Gross = 401688    Net = 314010     +/- 788
              CENTROID : 91.23   =   17.57keV
              SHAPE : Fwhm =   1.54keV    Fwtm =   3.15keV


ROI #  1-2    RANGE :  507 =  118.86keV  to  533 =  125.20keV
              AREA : Gross = 4747005   Net = 4608299    +/- 2257
              CENTROID : 519.87  =  122.00keV
              SHAPE : Fwhm =   1.58keV    Fwtm =   3.18keV


ROI #  1-3    RANGE :  564 =  132.75keV  to  590 =  139.09keV
              AREA : Gross = 598016    Net = 576455     +/- 807
              CENTROID : 577.33  =  136.00keV
              SHAPE : Fwhm =   1.59keV    Fwtm =   3.19keV
```

Figure 80. Example Spectrum Report

Files <Alt F>

Compare <Alt C>

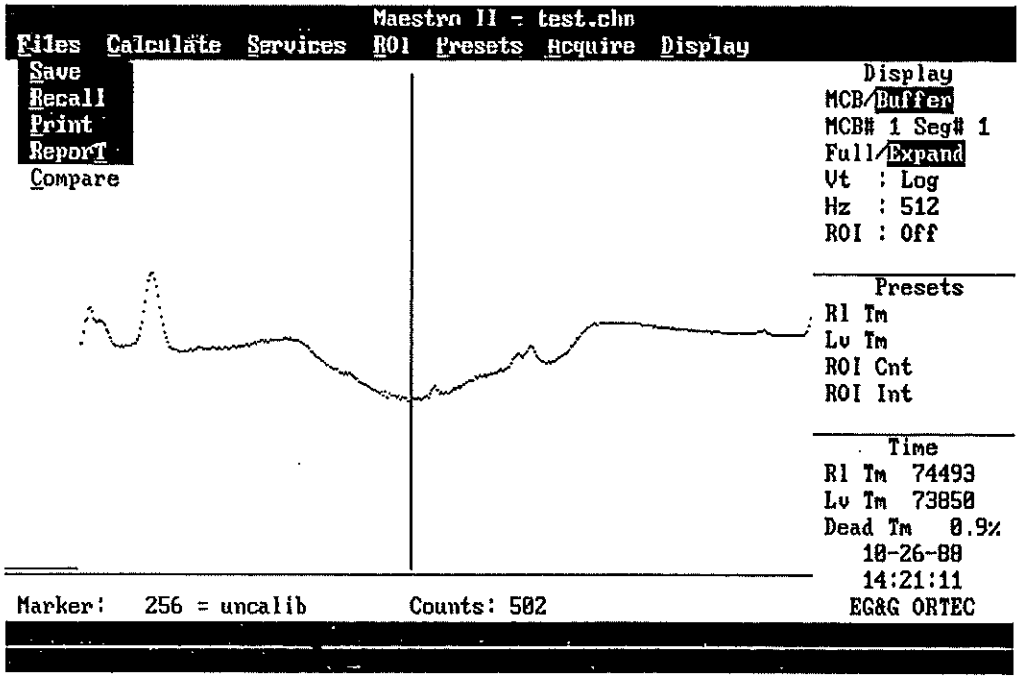


Figure 81. Compare Two Spectra

This command allows a disk spectrum to be displayed with the Buffer spectrum so that the two may be visually compared. The two spectra are in different colors (see M2COLORS). The Buffer must be in EXPANDED mode.

When the Compare function is selected, a list of spectra on the disk (in the default directory) will be displayed on the screen. See Figure 82. Use <up arrow> and <down arrow> to select the desired spectrum and <Enter> to process it. Only 11 spectrum names are shown at one time. To view more spectra, use <down arrow> to move the list up the screen. The <up arrow> will move the list down the screen.

If there are no spectra on the disk, the Enter Name screen (Figure 83) is displayed. If the spectrum desired is not shown on the list of spectra, enter the first character of the filename and the Enter Name screen will be displayed. Any DOS filename, including the drive and subdirectory name, can be entered.

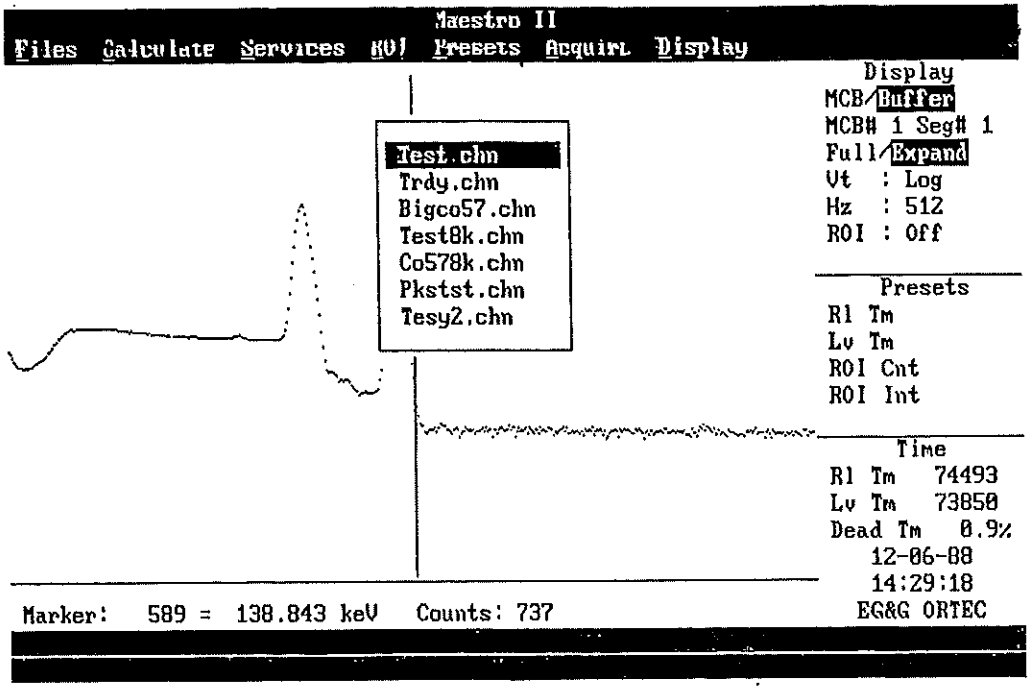


Figure 82. Compare Spectra File List

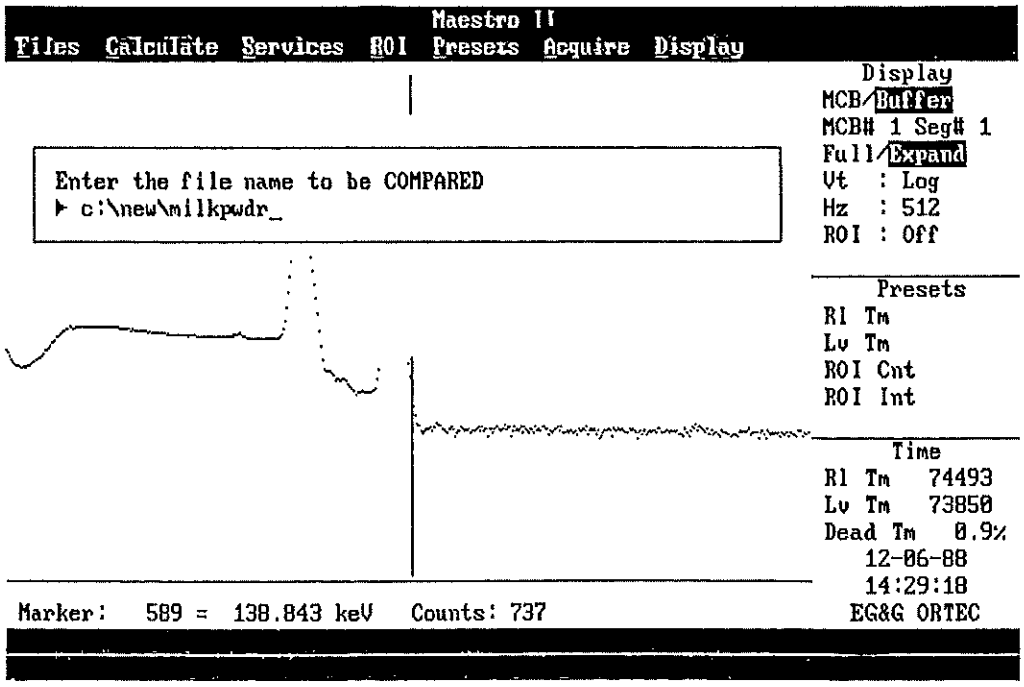


Figure 83. Compare Spectra Filename Entry

When in Compare mode, the disk spectrum can be moved vertically with <shift up arrow> and <shift down arrow> (see Figure 84). To exit Compare mode use <Esc>.

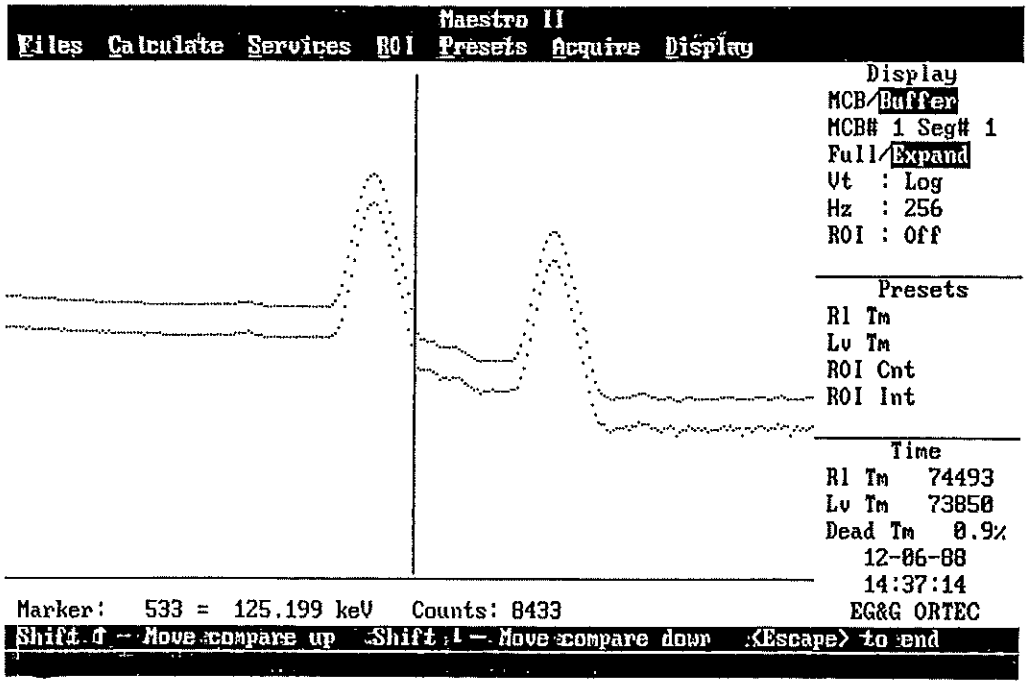


Figure 84. Compare Display

The spectrum can be expanded and contracted both vertically and horizontally; however, all other keys (except <shift up arrow>, <shift down arrow> and <Esc>) are disabled in this mode.

Use <Esc> to return to the normal display.

Services <Alt S>

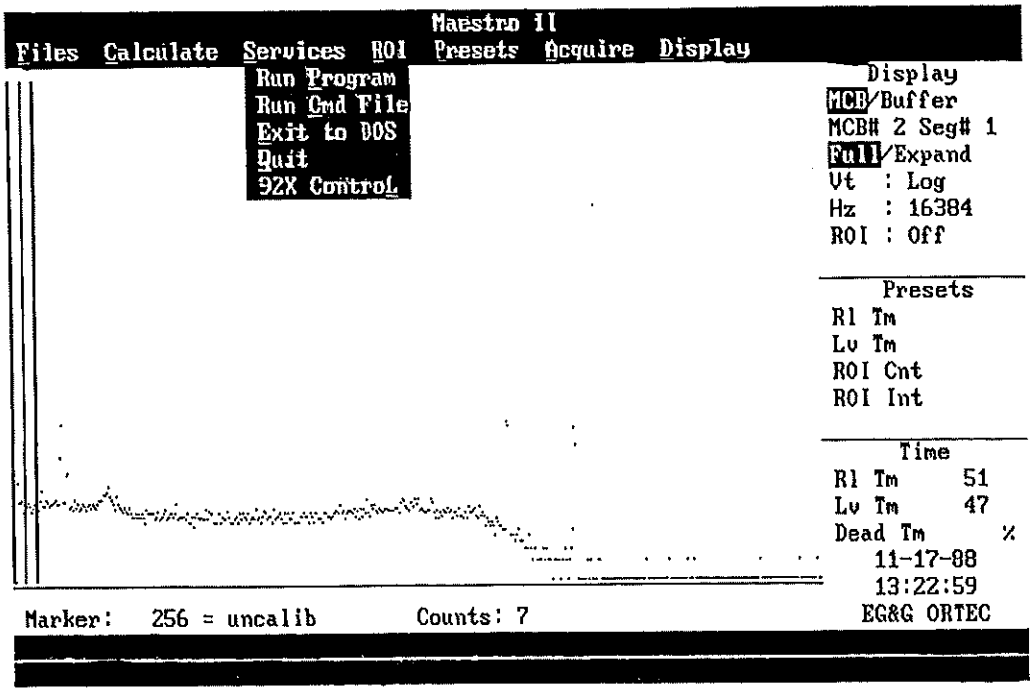


Figure 85. Services Menu

<Alt S> pulls down the Services menu. This menu is shown in Figure 85. If the display is showing an MCB, the spectrum display is switched to the Buffer. The Services functions are only available for the Buffer.

The 92X Control option only appears when the active MCB (see upper right of display) is a 92X MCB.

When this menu is displayed, the screen display is not updated. Use the <Alt> and the underscored letter to perform the function or use the <up arrow> and <down arrow> to select the menu item and <Enter> to perform the action. The <left arrow> moves to the Files menu and the <right arrow> moves to the Calculate menu. The <Esc> clears the menu without doing any action, redraws the spectrum display and returns to the monitoring mode.

Services <Alt S>

Run Program <Alt P>

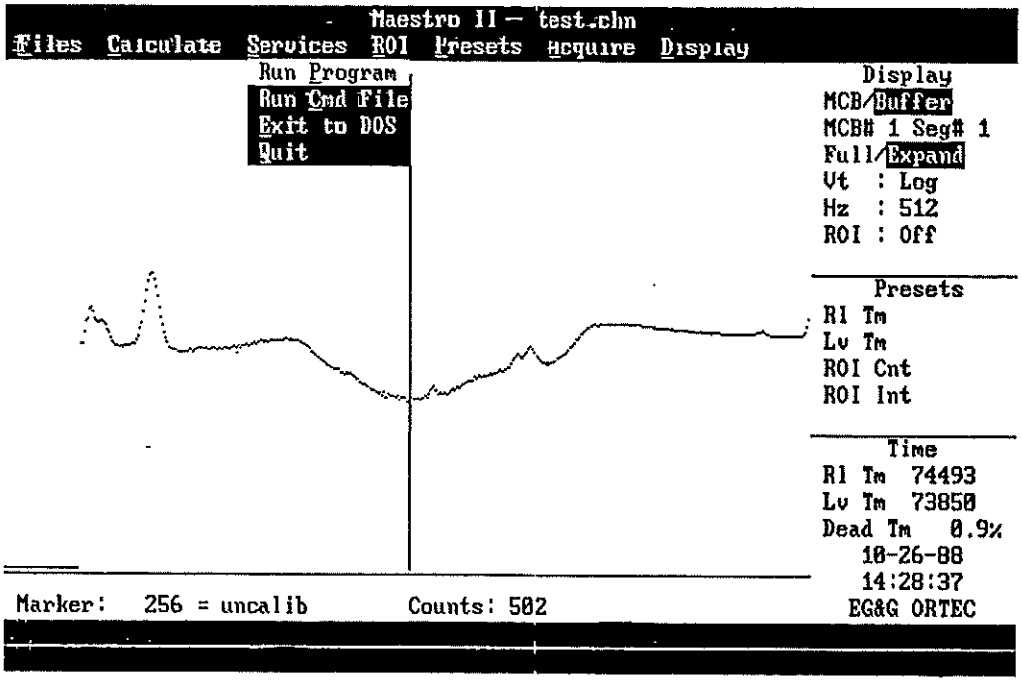


Figure 86. Run a DOS Program

This command executes one DOS EXE or DOS COM program. The user enters the name of the program in Figure 87. Redirection (see DOS manual) is not supported. The program COMMAND (a part of DOS) can be used to run a daughter copy of DOS which supports the redirection and Batch files. To accomplish this, type "COMMAND/C" and the program name in Figure 87. The following is an example of an entry:

COMMAND/C TEST >PRN

If the program executes correctly with an ERRORLEVEL (a DOS variable) of 0, the MAESTRO II displays a "successful" message. Otherwise, the screen is left on for a short time before the emulation screen is redrawn with the "unsuccessful" message. If the user program does not set the ERRORLEVEL correctly, the successful or unsuccessful message may not be properly displayed.

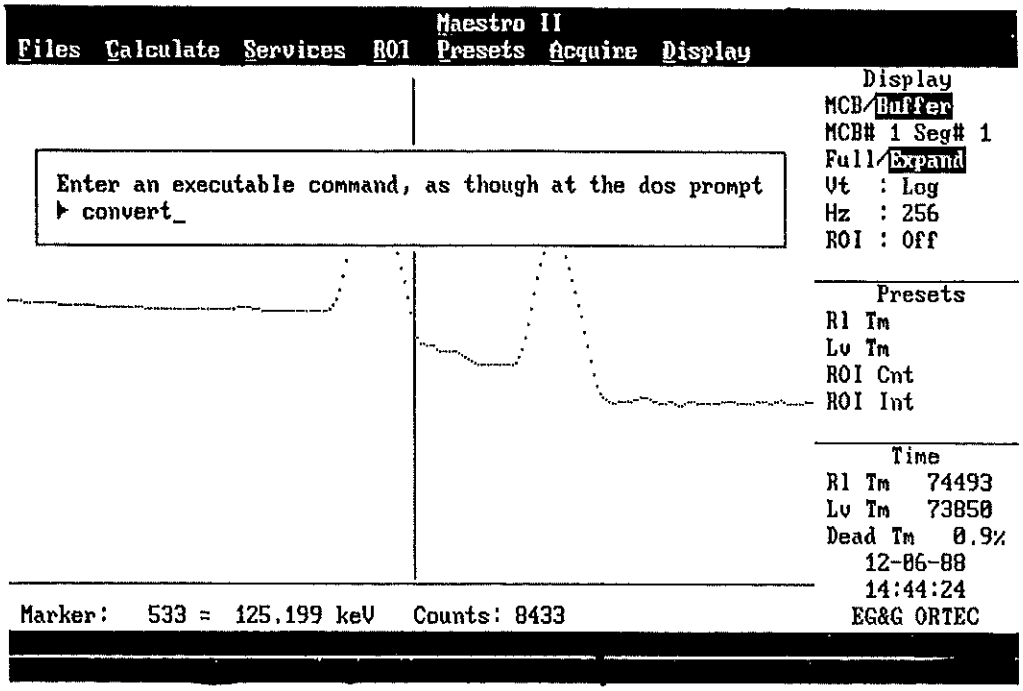


Figure 87. Enter a Program Name

If COMMAND/C is entered as the program name, a new copy of DOS is loaded into the computer. In order to leave this mode and return to the MCA display, type "EXIT" <Enter> at the DOS prompt.

Services <Alt S>

Run Cmd File <Alt C>

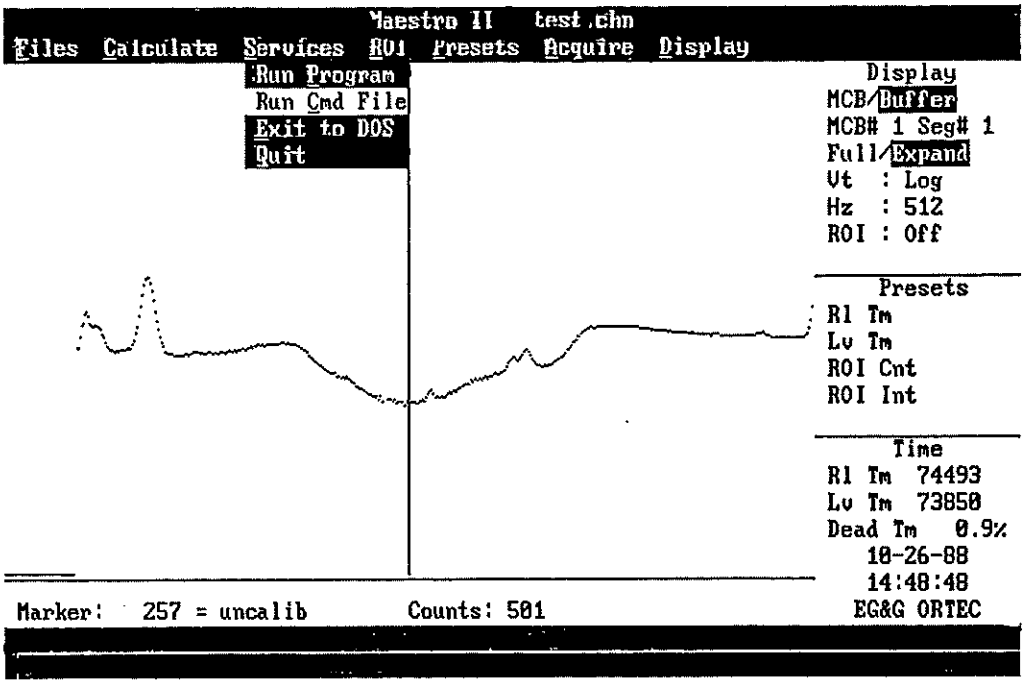


Figure 88. Run Command File

This command executes a MAESTRO II command file. After executing the MAESTRO II command file, the operation returns to normal. The Quit command will exit from the MAESTRO II and return to DOS. The command files are written by the user and converted to MAESTRO II format by the program PARSE. The command files are discussed in detail in the Command File section.

Many analysis functions can be automated with the command files. Any number of command files can be saved on disk and executed by the user when needed.

Only the display functions are operational when a command file is executing. Use <Esc> to exit this mode.

When the Run Command function is selected, a list of the files with the CMD extension on the disk (in the default directory) will be displayed on

the screen. See Figure 89. Use <up arrow> and <down arrow> to select the desired file and <Enter> to process it. Only 11 filenames are shown at one time. To view more filenames, use <down arrow> to move the list up the screen. The <up arrow> will move the list down the screen.

If there are no command files on the disk, the Enter Name screen (Figure 90) is displayed. If the file desired is not shown on the list of files, enter the first character of the filename and the Enter Name screen will be displayed. Any DOS filename, including the drive and subdirectory name, can be entered.

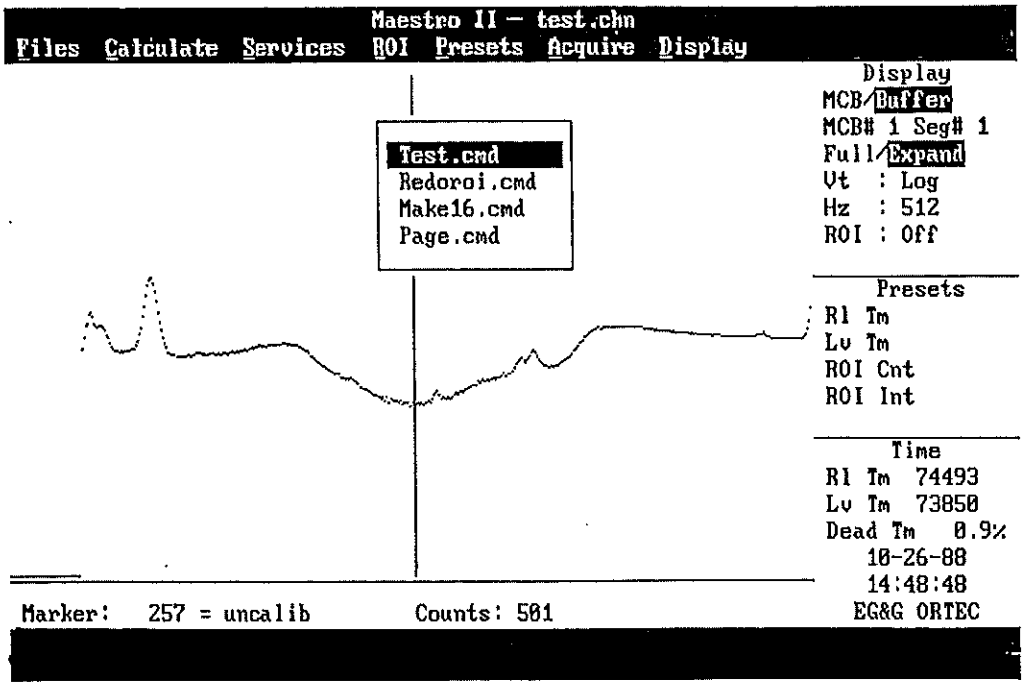


Figure 89. Command File Filenames

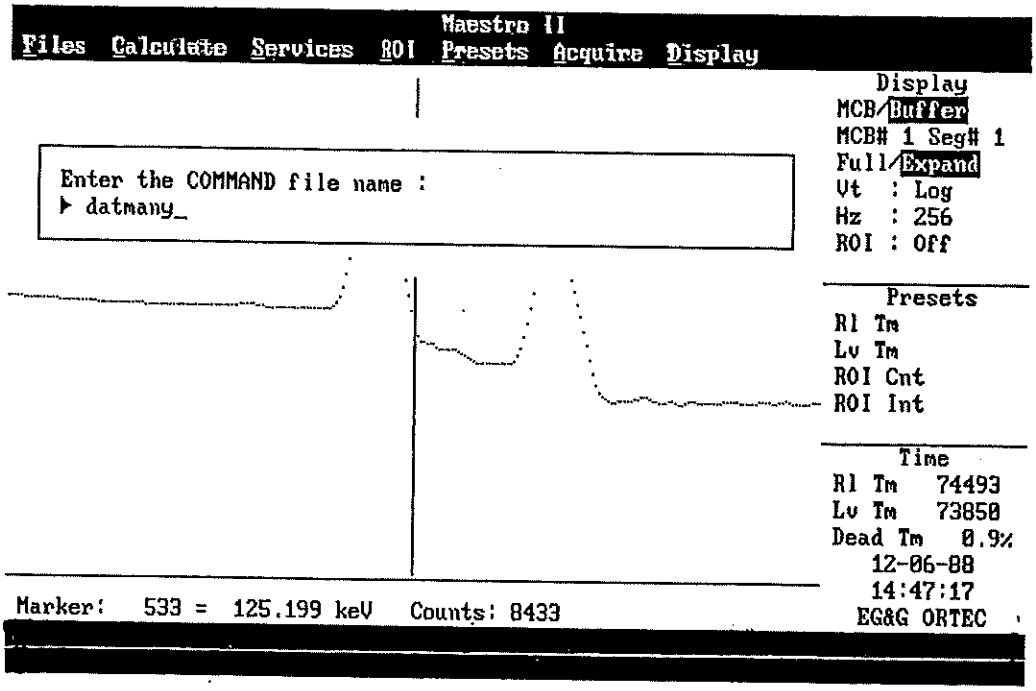


Figure 90. Command Filename Entry

Services <Alt S>

Exit to DOS <Alt E>

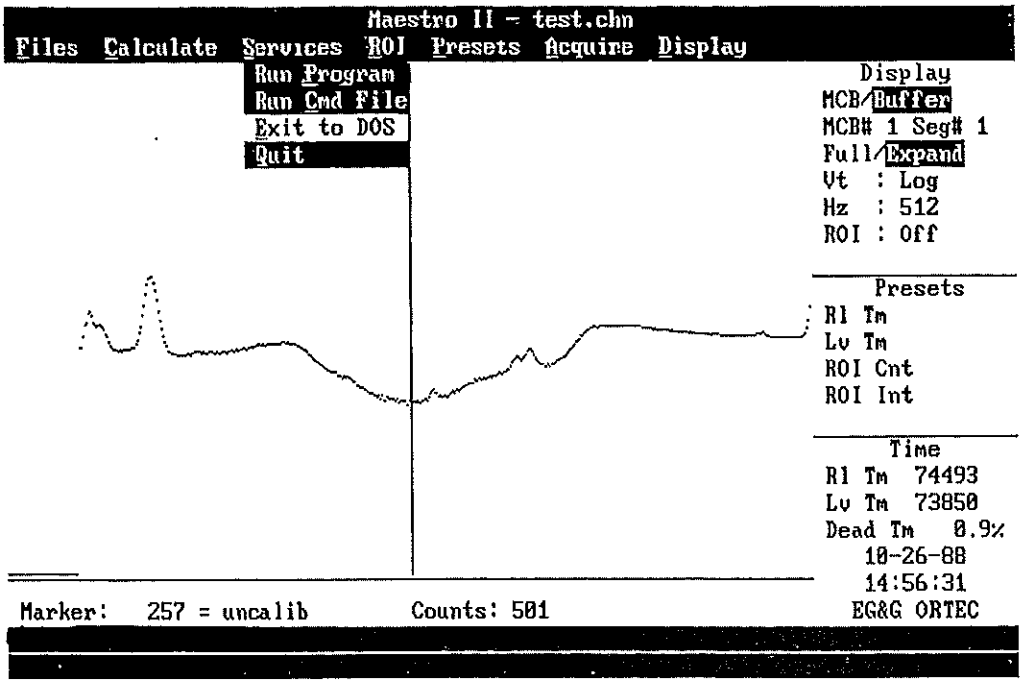


Figure 91. Exit to DOS

This command allows leaving the MAESTRO II to go into DOS, execute any DOS command or program, and return to the MAESTRO II to continue with the emulation program. All the data and presets are preserved. This function is useful in switching directories, searching for files, or running other programs to control hardware, such as CCNIM. Any changes to the operating conditions (e.g., switching directories) remain in effect when control is returned to the MAESTRO II.

This process is done by loading and executing another copy of the DOS program. The MAESTRO II remains in memory. The type of functions that can be executed is dependent on the memory size of the computer. Certain user functions may not execute in the minimum memory configuration.

To return to the MAESTRO II, type "EXIT"<Enter>. The screen returns to the emulation display.

Services <Alt S>

Quit <Alt Q>

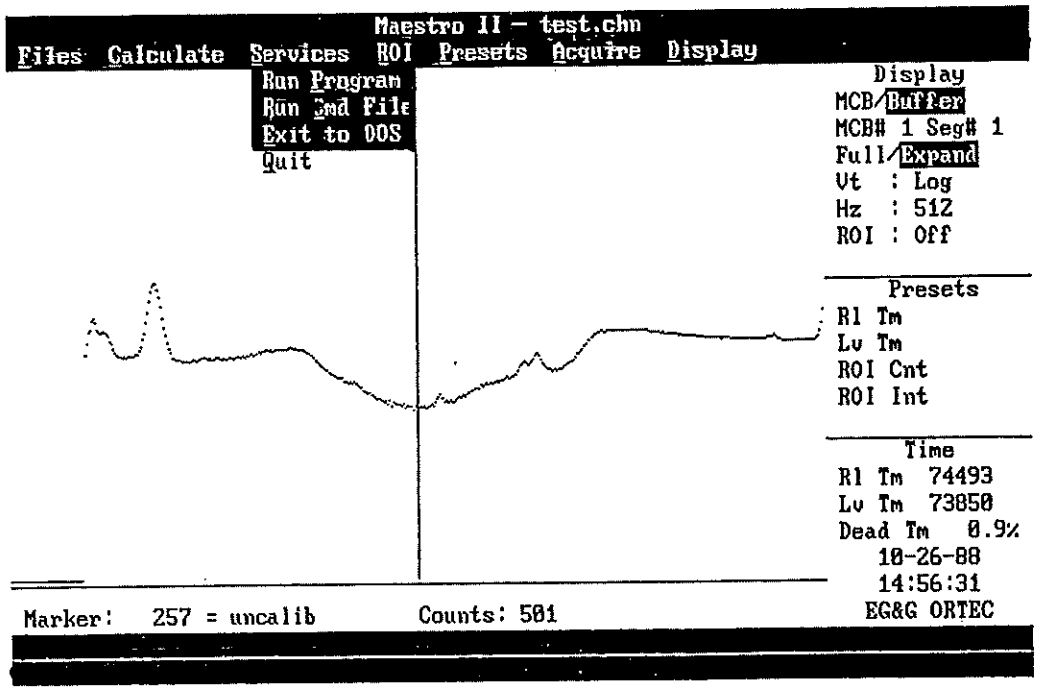


Figure 92. Quit MAESTRO and Return to DOS

This command exits the MCA program and returns the system to DOS. The user is asked to verify the Quit (see Figure 93) because the spectrum data in the internal Buffer is lost. All preset data and calibration data are saved.

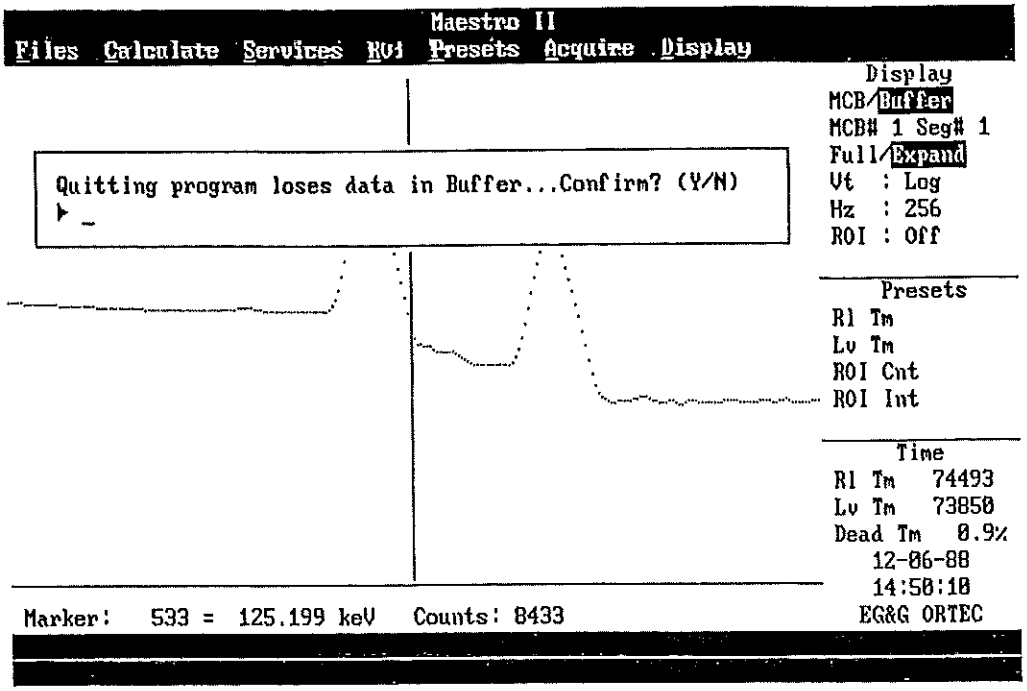


Figure 93. Verify Quitting

Reply "Y" to return to DOS; "N" to remain in the MAESTRO II.

Services <Alt S>

92X Control <Alt L>

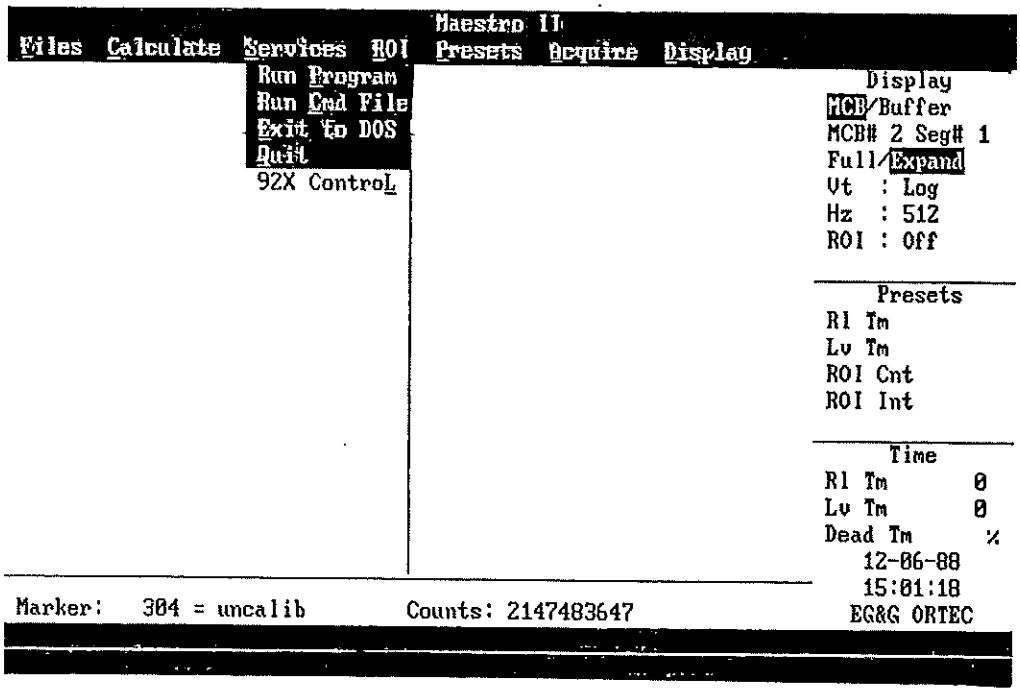


Figure 94. Pull Down the 92X Control Menu

This command displays the current 92X status for amplifier coarse gain, amplifier fine gain, amplifier shaping time, high voltage on/off status and value, and automatic pole zero trigger or transistor reset preamplifier options. These settings can also be changed from this menu.

Figure 95 shows the 92X Control menu. When first displayed it shows the current values from the 92X. To exit from this menu press <Esc>.

Use <up arrow> and <down arrow> to select the option desired and <Enter> to exercise the function. After performing the function, this menu is redisplayed.

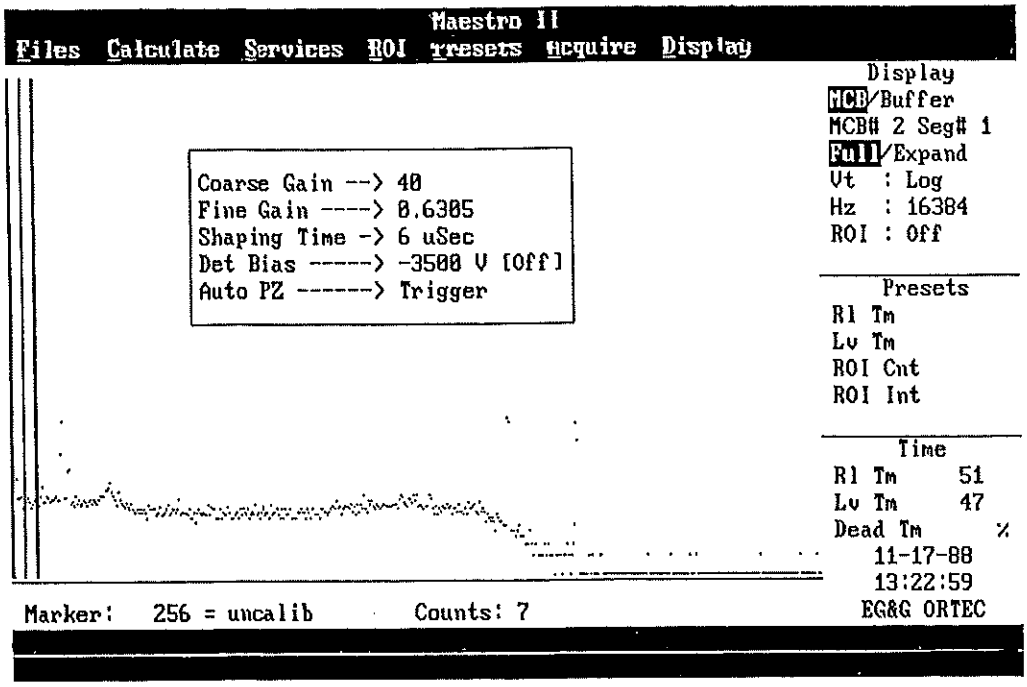


Figure 95. 92X Control Menu

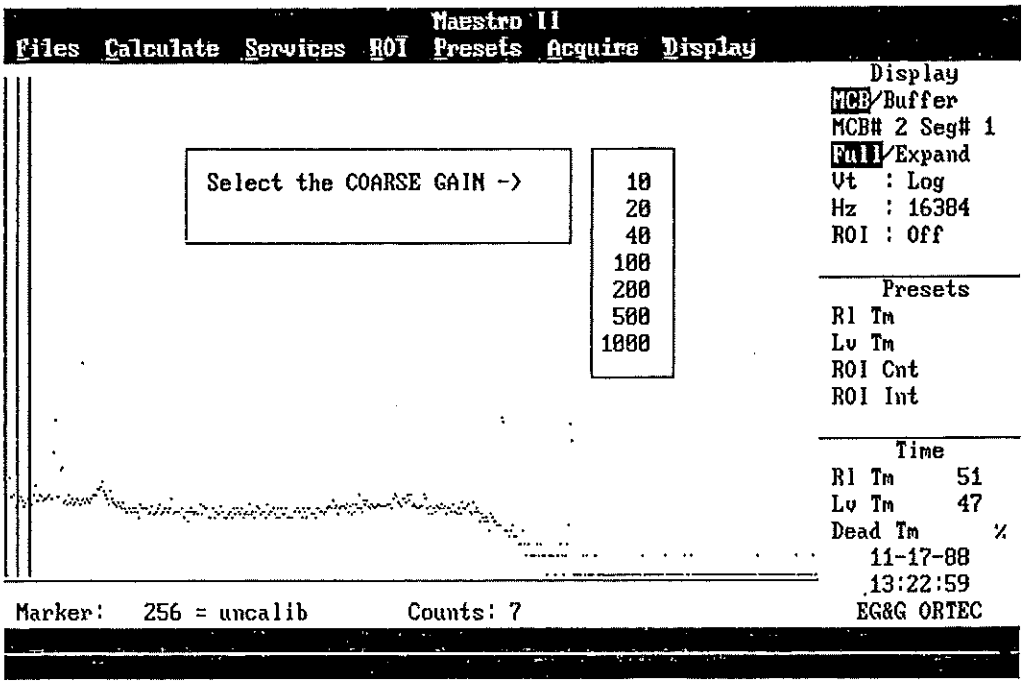


Figure 96. 92X Coarse Gain Select

The Coarse Gain selection menu is shown in Figure 96. The 92X has the gain settings shown in the list. These settings, coupled with the fine gain of 0.4 to 1.0, cover the range of amplification from 4.0 to 1000.

Use <up arrow> and <down arrow> to select the desired gain and <Enter> to implement it. The gain command is sent to the 92X at this time and, if the 92X is able to implement the gain change, the message "92X accepts command" will be displayed in the message box. If the 92X is unable to make the gain request, a "92X rejects command" message is displayed. The 92X should not normally reject the gain command.

To return to the 92X Control menu without changing the gain, press <Esc>.

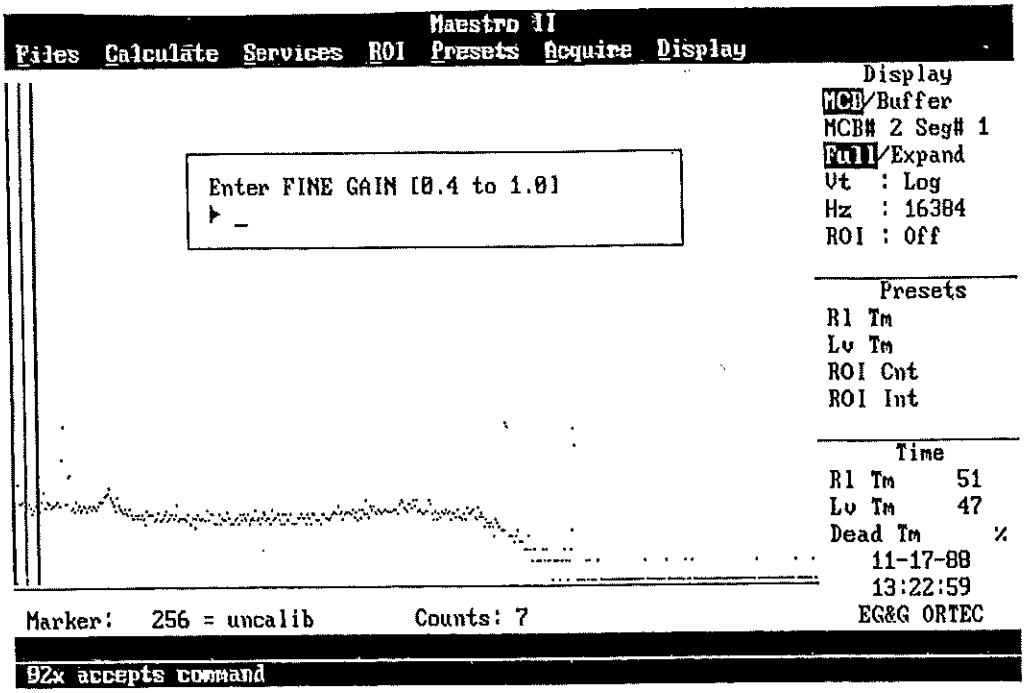


Figure 97. 92X Fine Gain Entry

The Fine Gain value entry is shown in Figure 97. The 92X fine gain can be set to any value between the limits shown. Up to 4 digits can be entered. This corresponds to a value set to 1 part in 4096. These values, coupled with the coarse gain of 10.0 to 1000.0, cover the range of amplification from 4.0 to 1000.

Enter the gain value desired and press <Enter>. The gain command is sent to the 92X at this time and, if the 92X is able to implement the gain change, the message "92X accepts command" will be displayed in the message box. If the 92X is unable to make the gain request, a "92X rejects command" message is displayed. The 92X should not normally reject the gain command.

To return to the 92X Control menu without changing the gain, press <Esc>.

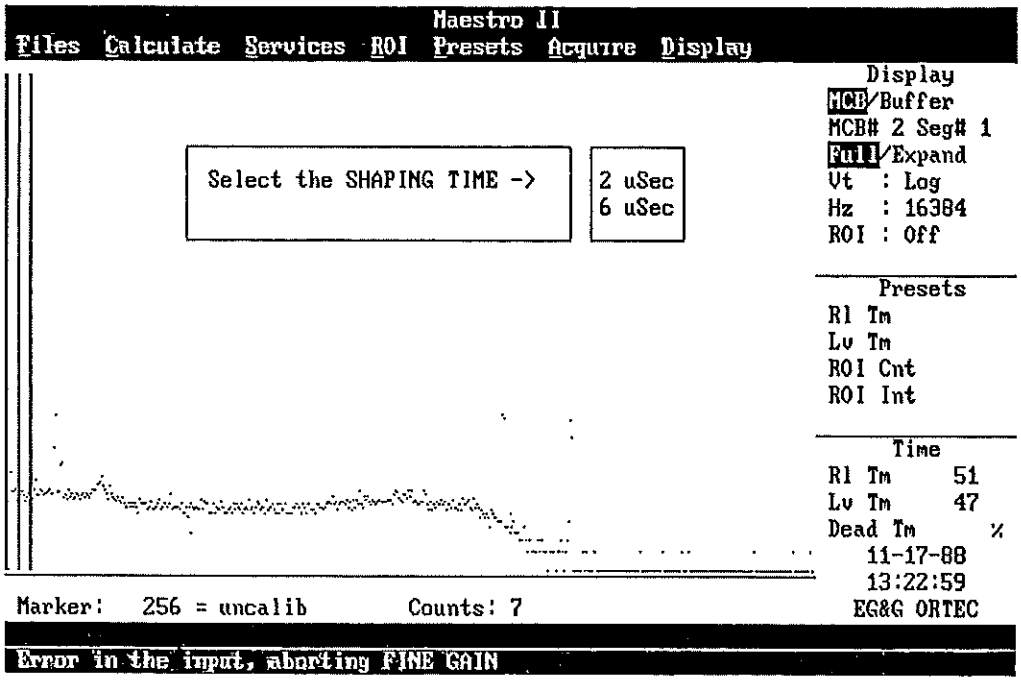


Figure 98. 92X Shaping Time Constant Select

The Shaping Time constant selection menu is shown in Figure 98. The 92X shaping time can be set to the values shown. These values cover the time constants needed for high count rate and high resolution systems.

Select the shaping time constant desired using <up arrow> or <down arrow> and press <Enter>. The time constant select command is sent to the 92X at this time and, if the 92X is able to implement the change, the message "92X accepts command" will be displayed in the message box. If the 92X is unable to make the request, a "92X rejects command" message is displayed. The 92X should not normally reject the shaping time constant select command.

To return to the 92X Control menu without changing the time constant, press <Esc>.

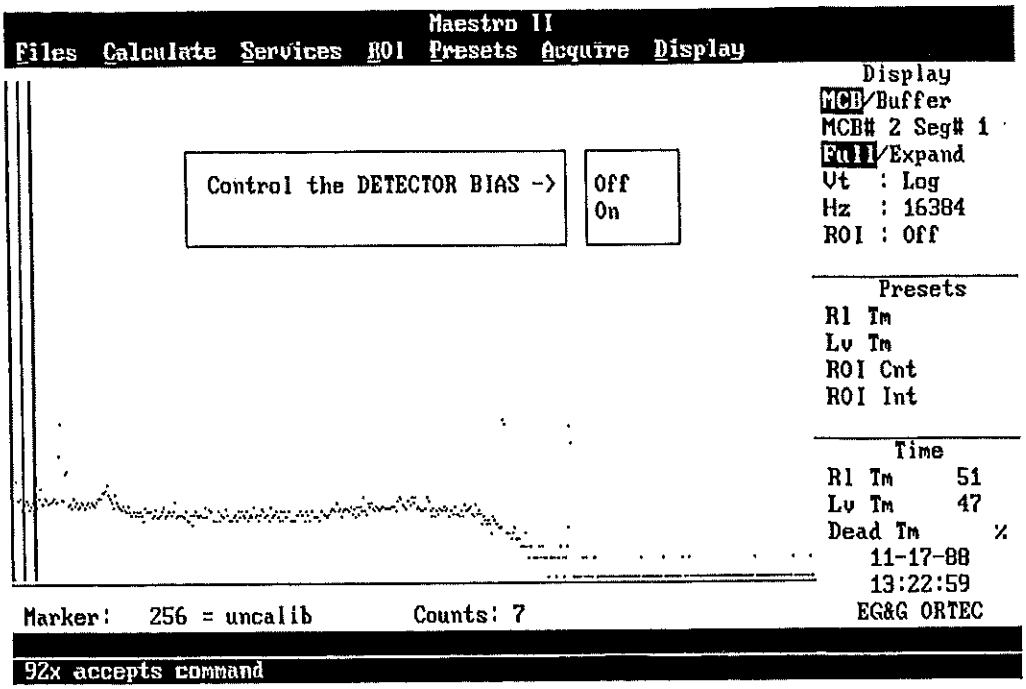


Figure 99. 92X Detector Bias Enable/Disable

The high voltage (Detector Bias) enable/disable selection is shown in Figure 99. The 92X high voltage can be enabled or disabled by MAESTRO II. The detector bias is also controlled by the detector bias remote shutdown signal from the detector. The voltage level is controlled by the hardware and is adjusted by a potentiometer on the rear panel (see hardware manual). The polarity is also adjustable by an internal jumper.

Select the desired state and press <Enter>. The bias on command is sent to the 92X at this time and, if the 92X is able to implement the bias change, the message "92X accepts command" will be displayed in the message box. If the 92X is unable to make the bias request, a "92X rejects command" message is displayed. The 92X will reject the bias on command if the remote shutdown or overload signals are disabling the high voltage.

To return to the 92X Control menu without changing the status, press <Esc>.

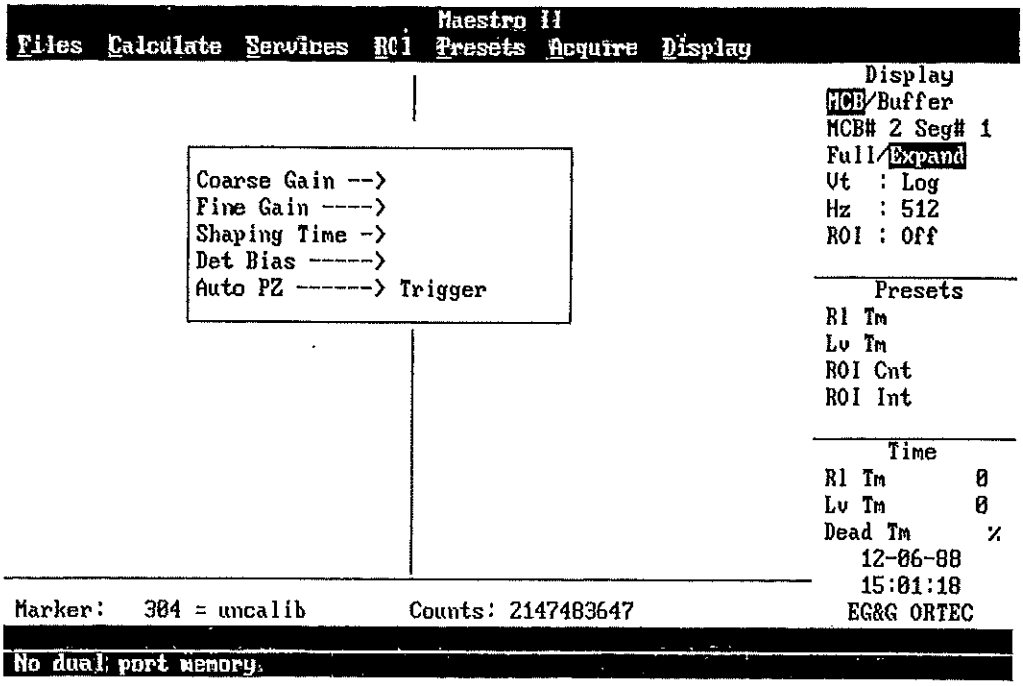


Figure 100. 92X Amplifier PZ Trigger

The Amplifier Pole Zero Trigger option is shown in Figure 100. The 92X amplifier is equipped with an automatic pole zero circuit. This can be activated by MAESTRO II. If transistor reset preamplifier was selected for this 92X in the M2SETUP program then this option is not used. As with any system, the amplifier should be PZed anytime the detector is changed, the shaping time of the amplifier is changed or the power to the module is turned off. The pole zeroing operation requires the amplifier to be amplifying pulses. The detector should be connected in the final configuration before pole zeroing is started. There should be a radioactive source near the detector so that the count rate will be high enough to accomplish the pole zero in the proper time.

Select the PZ trigger option and press <Enter>. The pole zero command is sent to the 92X at this time and, if the 92X is able to start the pole zero operation, the message "pole zero in progress" will be displayed in the message box. When the pole zeroing is finished, the message "pole zero complete" is displayed in the message box. If the 92X is unable to start the pole zero process, a "92X rejects command" message is displayed. The 92X will not normally reject the pole zero command.

Without an oscilloscope (connected to the amplifier output) to see the pulse shape, the effect of the pole zero operation is not always easy to see. The most common effect of an incorrect pole zero setting is tailing on the peak shape in the spectrum. Here, tailing refers to abnormally high counts on either side of the peak. If the amplifier was close to properly pole zeroed before the operation, the spectrum peak shape may not change enough to be seen.

Notes

KEYBOARD FUNCTIONS

This section describes the operations of all the keys not used by the menus described above. All of the direct functions are in this section.

The keys are grouped by location on the keyboard. Multikey functions, such as <Alt 1>, are executed by holding down the Alt key while pressing a number key on the top row of the keyboard.

The keyboard with the diagram of all the functions is shown in Figure 3.

MARKER MOVEMENT/PEAK LOCATION KEYS

Page Down

<Pg Dn> (on enhanced keyboards, also <Page Down>) moves the cursor at high speed to the data channels on the left. When the window is EXPANDED, the peak moves to the right of the display. The status of the ROI bit will not be altered when the cursor is moved with <Pg Dn>.

The marker channel contents are continuously updated. When the motion stops, the channel contents are up-to-date.

The key is active at all times except when a pull-down menu is displayed.

If the display is segmented and EXPANDED, the cursor cannot be moved below channel 0 of the segment (see <shift page down>). In FULL mode, the cursor can cross the segment boundary.

MARKER MOVEMENT/PEAK LOCATION KEYS

Page Up

<Pg Up> (on enhanced keyboards, also <Page Up>) moves the cursor at high speed to the data channels on the right. When the window is EXPANDED the peaks move to the left. The status of the ROI bit will not be altered when the cursor is moved with <Pg Dn>.

The marker channel contents are continuously updated. When the motion stops, the channel contents are up-to-date.

The key is active at all times except when a pull-down menu is displayed.

If the display is segmented and EXPANDED, the cursor cannot be moved past the end of the segment (see <shift page up>). In FULL mode, the cursor can cross the segment boundary.

MARKER MOVEMENT/PEAK LOCATION KEYS

Shift -- >

The <shift right arrow> moves the marker to the beginning of the next higher channel ROI of the active segment in the Buffer or the MCB. In FULL mode, the entire display is used; i.e., the search crosses segment boundaries.

MARKER MOVEMENT/PEAK LOCATION KEYS

Shift <--

The <shift left arrow> moves the marker to the end of the preceding (or lower) channel ROI of the active segment in the Buffer or MCB. In FULL mode, the entire display is used; i.e., the search crosses segment boundaries.

MARKER MOVEMENT/PEAK LOCATION KEYS

Home

This key moves the marker to channel 0 of the displayed segment. In FULL mode, the key moves the left edge of the window to channel 0 of segment 1.

MARKER MOVEMENT/PEAK LOCATION KEYS

End

This key moves the marker to the last channel of the active segment. In FULL mode, the key moves the right edge of the window to the far right of the display.

MARKER MOVEMENT/PEAK LOCATION KEYS

Shift Page Up

This key moves the cursor to the beginning of the next (higher) segment. If only one segment is defined, no action is taken. In EXPANDED mode, <shift Pg Up> and <shift Pg Dn> are the only ways to move from segment to segment.

MARKER MOVEMENT/PEAK LOCATION KEYS

Shift Page Down

This key moves the marker to the beginning of the preceding (lower) segment. If only one segment is defined, then no action is taken. In EXPANDED mode, <shift Pg Dn> and <shift Pg Up> are the only ways to move from segment to segment.

MARKER MOVEMENT/PEAK LOCATION KEYS

Ctrl -->

The <Ctrl right arrow> performs a peak search on the spectrum in the Buffer in the higher channel direction and moves the marker to the first peak found. If no peak is found, the program displays a message (no more peaks) and the marker does not move. If the Buffer has been energy-calibrated, and the library LIB.MCB has been loaded, the system displays the best match from the library within two FWHMs of the peak centroid. If there is no match within this range, then the message "no close library match" is displayed.

MARKER MOVEMENT/PEAK LOCATION KEYS

Ctrl <--

The <Ctrl left arrow> performs a peak search on the spectrum in the Buffer in the lower channel direction and moves the marker to the first peak found. If no peak is found, the program displays a message (no more peaks) and the marker does not move. If the Buffer has been energy-calibrated, and the library LIB.MCB has been loaded, the system displays the best match from the library within two FWHMs of the peak centroid. If there is no match within this range, then the message "no close library match" is displayed.

MARKER MOVEMENT/PEAK LOCATION KEYS

Keypad -

In FULL mode (see Display, Full/Expand), <keypad -> contracts the width of the window around the marker. The window is defined by the vertical bars above and below the marker. This window is the full width of the expanded data. In EXPANDED mode, <keypad -> contracts the horizontal scale of the data display, so that the peaks become more narrow. The maximum width is 1024 channels.

The <keypad -> is used with <keypad + > to adjust the width of the window.

The full scale value is shown on the right of the screen.

The key is active at all times except when a pull-down menu is displayed.

See Figure 3 for the placement of this key.

MARKER MOVEMENT/PEAK LOCATION KEYS

Keypad +

In FULL mode (see Display, Full/Expand), <keypad + > expands the width of the window around the marker. The window is defined by the vertical bars above and below the marker. This window is the full width of the expanded data. In EXPANDED mode, <keypad + > expands the horizontal scale of the data display, so that the peaks become wider. The minimum width is 16 channels.

The <keypad + > is used with <keypad -> to adjust the width of the window.

The full scale value is shown on the right of the screen.

The key is active at all times except when a pull-down menu is displayed.

See Figure 3 for the placement of this key.

MARKER MOVEMENT/PEAK LOCATION KEYS

Ins

This key (on enhanced keyboards, also <Insert>) marks an ROI in the Buffer spectrum, at the marker position, in one of two ways:

1. If the Buffer is calibrated, the region is centered on the marker with a width of three times the calibrated FWHM. There does not need to be a peak at the marker position.

2. If the Buffer is not calibrated, the region is centered on the peak located within two channels of the marker and as wide as the peak. If the peak search fails, or if the peak is not well-formed, no ROI is marked. There is no limit on the size of a peak or ROI, so in some uncalibrated spectra large ROIs may be marked.

<Insert> works well in combination with Ctrl<-- or Ctrl ->.

MARKER MOVEMENT/PEAK LOCATION KEYS

Del

This key (on enhanced keyboards, also <Delete>) deletes or clears the ROI in the Buffer that is marked by the marker. All contiguous ROI channels are cleared.

MARKER MOVEMENT/PEAK LOCATION KEYS

Up Arrow

The <up arrow> performs one of two functions depending on the MAESTRO II mode:

Display mode

The <up arrow> changes the vertical scale of the histogram display so that the peaks are larger. The minimum is 16-counts-full-scale. Each successive key press will halve the maximum until 16 counts is reached.

The status of the vertical scale maximum is shown on the right of the screen.

The <up arrow> is the opposite of the <down arrow>.

Menu mode

The <up arrow> is used to go to the menu item above the currently highlighted menu item. If at the top or none is highlighted, it goes to bottom of the list.

MARKER MOVEMENT/PEAK LOCATION KEYS

Down Arrow

The <down arrow> performs one of two functions depending on the MAESTRO II mode:

Display mode

The <down arrow> changes the vertical scale of the histogram display so that the peaks are smaller. Each successive key press will double the maximum until 8 million is reached. The next key press will switch to log scale. In log mode no action is taken.

The status of the vertical scale maximum is shown on the right of the screen.

The <down arrow> is the opposite of the <up arrow>.

Menu mode

The <down arrow> is used to go to the menu item below the currently highlighted menu item. If at the bottom or none is highlighted, it goes to top of the list.

KEYBOARD NUMBERS

Alt 1 Start

The <Alt 1> will start the acquisition in the selected MCB. The selected MCB, or active MCB, is shown in the upper right of the display. If any presets are desired, the presets must be entered before starting the acquisition.

This duplicates the <Alt A>, <Alt T> function, which contains more details on this command.

Note: Only the keyboard numbers will operate in this mode. The keypad number keys will not perform these functions.

KEYBOARD NUMBERS

Alt 2 — Stop

The <Alt 2> will stop the acquisition in the selected MCB. The selected MCB, or active MCB, is shown in the upper right of the display.

This duplicates the <Alt A>, <Alt P> function, which contains more details on this command.

Note: Only the keyboard numbers will operate in this mode. The keypad number keys will not perform these functions.

KEYBOARD NUMBERS

Alt 3 — Clear

The <Alt 3> will clear the histogram data, the realtime and livetime of the selected MCB. The selected MCB, or active MCB, is shown in the upper right of the display.

This duplicates the <Alt A>, <Alt C> function, which contains more details on this command.

Note: Only the keyboard numbers will operate in this mode. The keypad number keys will not perform these functions.

KEYBOARD NUMBERS

Alt 4 — Full/Expand

The <Alt 4> will switch the display between the FULL and EXPANDED mode. The status of the display is shown in the upper right of the display.

This duplicates the <Alt D>, <Alt F> function, which contains more details on this command.

Note: Only the keyboard numbers will operate in this mode. The keypad number keys will not perform these functions.

KEYBOARD NUMBERS

Alt 5 MCB -> Buffer

The <Alt 5> copies the histogram data from the selected MCB to the internal Buffer. The selected MCB, or active MCB, is shown in the upper right of the display.

This duplicates the <Alt A>, <Alt B> function, which contains more details on this command.

Note: Only the keyboard numbers will operate in this mode. The keypad number keys will not perform these functions.

KEYBOARD NUMBERS

Alt 6 MCB/Buffer

The <Alt 6> will switch the display between the selected MCB and the internal Buffer. The MCB shown in the upper right of the display is the active MCB if displaying the MCB, and is the MCB where the data was collected if displaying the internal Buffer.

This duplicates the <Alt D>, <Alt M> function, which contains more details on this command.

Note: Only the keyboard numbers will operate in this mode. The keypad number keys will not perform these functions.

KEYBOARD NUMBERS

Alt - (92X only) Fine Gain Down

The <Alt -> will step the 92X internal amplifier down by one increment of fine gain on the selected MCB. The selected MCB, or active MCB, is shown in the upper right of the display. The new setting of the fine gain is shown in the message box at the bottom of the screen. If the gain stabilizer is active, the display of the histogram data may not change.

The fine gain can also be set by the <Alt S>, <Alt L> fine gain function, which contains more details on this command.

This key is the minus and underscore key in the main section of the keyboard. Figure 3 shows this key on the enhanced keyboard. Figure 4 shows this key on the regular keyboard.

Note: Only the keyboard numbers will operate in this mode. The keypad number keys will not perform these functions.

KEYBOARD NUMBERS

Alt + (92X only) Fine Gain Up

The <Alt + > will step the 92X internal amplifier up by one increment of fine gain on the selected MCB. The selected MCB, or active MCB, is shown in the upper right of the display. The new setting of the fine gain is shown in the message box at the bottom of the screen. If the gain stabilizer is active, the display of the histogram data may not change.

The fine gain can also be set by the <Alt S>, <Alt L> fine gain function, which contains more details on this command.

This key is the equal and plus key in the main section of the keyboard. Figure 3 shows this key on the enhanced keyboard. Figure 4 shows this key on the regular keyboard.

Note: Only the keyboard numbers will operate in this mode. The keypad number keys will not perform these functions.

KEYBOARD NUMBERS

Shift Alt - (92X only)

The <shift Alt -> will step the 92X internal amplifier down by ten increments of fine gain on the selected MCB. The selected MCB, or active MCB, is shown in the upper right of the display. The new setting of the fine gain is shown in the message box at the bottom of the screen. If the gain stabilizer is active, the display of the histogram data may not change.

The fine gain can also be set by the <Alt S>, <Alt L> fine gain function, which contains more details on this command.

This key is the minus and underscore key in the main section of the keyboard. Figure 3 shows this key on the enhanced keyboard. Figure 4 shows this key on the regular keyboard.

KEYBOARD NUMBERS

Shift Alt + (92X only)

The <shift Alt + > will step the 92X internal amplifier up by ten increments of fine gain on the selected MCB. The selected MCB, or active MCB, is shown in the upper right of the display. The new setting of the fine gain is shown in the message box at the bottom of the screen. If the gain stabilizer is active, the display of the histogram data may not change.

The fine gain can also be set by the <Alt S>, <Alt L> fine gain function, which contains more details on this command.

This key is the equal and plus key in the main section of the keyboard. Figure 3 shows this key on the enhanced keyboard. Figure 4 shows this key on the regular keyboard.

FUNCTION KEYS

F1 Help

<F1> displays the help screen (see Figure 101) for the keyboard funcitons.

The <F1> is operational at all times except in Compare mode and when a pull-down menu is displayed.

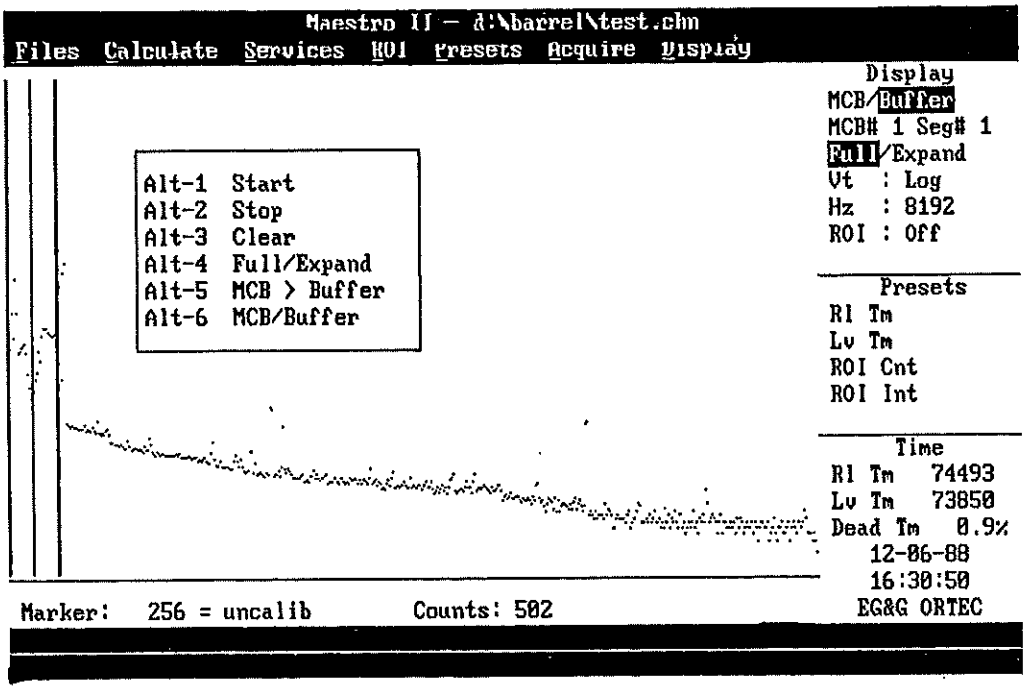


Figure 101. Keyboard Help Screen

FUNCTION KEYS

F2 ROI

The <F2> switches among three positions to alter the ROI status (Mark, Unmark or Off) in the MCB memory or the data Buffer memory of the PC. The ROI status is shown on the right of the screen. The status modes are the following:

Mark - The channel is marked as an ROI (set)
Unmark - The channel is removed from the ROI (reset)
Off - The ROI status is unchanged (Off)

The bit is marked or removed by moving the cursor to the channel.

The function moves from Mark to Unmark to Off to Mark with each successive operation of <F2>.

The F2 key is active except in Compare mode and when a pull-down menu is displayed.

FUNCTION KEYS

F3 Full/Expand

The <F3> switches between FULL memory display and EXPANDED memory display and works on both the MCB and data Buffer memory. See also F7 and F8. The <F3> duplicates <Alt 4>.

The section in the window of the FULL memory is expanded to fill the horizontal screen. The cursor is in the center of the screen.

The status of the FULL or EXPANDED display is shown in reverse video on the left of the screen.

The <F3> is active at all times except in the Compare mode and when a pull-down menu is displayed.

FUNCTION KEYS

F4 MCB/Buffer

The <F4> switches between the display of the data in the MCB and the data in the PC's internal Buffer. The Buffer will have the memory size and segmentation of the spectrum that was last transferred (or read from disk). At start up, the Buffer is defined as 16384 channels and one segment.

The emulation displays the data in histogram form from either the selected MCB or the internal Buffer. The status of the display (MCB or IBM PC Buffer) is shown in reverse video on the right of the screen. The livetime, realtime, presets and deadtime (MCB only) are shown for the displayed data. The marker remains in the same channel in both views unless the PC Buffer and MCB do not have the same segmentation. The FULL/EXPANDED status and the vertical scale are the same in both views.

For functions that work only on the Buffer data, the program automatically executes F4.

See also Select MCB and Full/Expand.

The display can also be toggled with <Alt 6>.

The <F4> is active at all times except in the Compare mode and when a pull-down menu is displayed.

FUNCTION KEYS

F5 Vertical Scale

The <F5> moves the vertical scale maximum up so that peaks are decreased in size. A 7-decade logarithm scale is the upper limit. The maxima are even powers of two. If the number of counts exceeds the maximum value, then the following results:

Full The data above the maximum are represended as points at the maximum value. Other points are displayed at their value.

Expand All data points are displayed modulus the maximum value. This means that data below the maximum are displayed at their value; data above the maximum have the maximum value subtracted from them until the resultant value is below the maximum. This is also referred to as "rolling around."

This duplicates the <down arrow>.

The <F5> is used in conjunction with <F6> to adjust the display.

The status of the vertical scale maximum is shown on the right of the screen.

The key is active at all times except when a pull-down menu is displayed.

FUNCTION KEYS

F6 — Vertical Scale

The <F6> moves the vertical scale maximum down so that peaks are increased in size. The lower limit is 16-counts-full-scale. The maxima are even powers of two. This duplicates the <up arrow>.

<F6> is used in conjunction with <F5> to adjust the display.

The status of the vertical scale maximum is shown on the right of the screen.

The key is active at all times except when a pull-down menu is displayed.

FUNCTION KEYS

F7 Horizontal Scale

In FULL mode (see Display, FULL/EXPAND), <F7> contracts the width of the window around the marker. The window is defined by the vertical bars above and below the marker. This window is the full width of the expanded data. In EXPANDED mode, <F7> contracts the horizontal scale of the data display so that the peaks become narrower. The maximum width is 1024 channels. This duplicates <keypad ->.

<F7> is used with <F8> to adjust the width of the window.

The full scale value is shown on the right of the screen.

The key is active at all times except when a pull-down menu is displayed.

FUNCTION KEYS

F8 Horizontal Scale

In FULL mode (see Display, FULL/EXPAND), <F8> expands the width of the window around the marker. The window is defined by the vertical bars above and below the marker. This window is the full width of the expanded data. In EXPANDED mode, <F8> expands the horizontal scale of the data display so that the peaks become wider. The minimum width is 16 channels. This duplicates <keypad + >.

<F8> is used with <F7> to adjust the width of the window.

The full scale value is shown on the right of the screen.

The key is active at all times except when a pull-down menu is displayed.

FUNCTION KEYS

Ctrl F1 — Switch MCB

<Ctrl F1> switches to MCB #1. The data display, presets and elapsed times are all updated when the MCB number is changed.

This key selects MCB #1 for display when in the MCB mode (see Display, Select MCB).

This key is active except in Compare mode and when a pull-down menu is displayed. If the Buffer is displayed, <Ctrl F1> is used to switch to MCB mode to display MCB #1.

The MCB selected is shown in the upper right of the screen. The segment is selected by the position of the cursor.

FUNCTION KEYS

Ctrl F2 through Ctrl F8 — Switch MCB

These keys switch to the specified MCB, if that MCB was defined in the setup (see M2SETUP).

FUNCTION KEYS

Alt F8 — Serial-mode transfer

In the serial-only (Remote MCB, MCASER program) mode, this key transfers the contents of the MCB to the local display area (this is not the buffer).

In the serial-only setup, in which the MCB is in a remote location, all of the commands and data are transmitted over the RS-232 line. In this mode, there is no live display. The spectrum in the display buffer is manually updated by pressing <Alt F8>. Only the section of the memory displayed contains the updated data. In EXPANDED mode, only the displayed window is updated. In FULL mode, the complete buffer is transferred.

This key is only available on the SERIAL version.

ESCAPE KEY

Esc — Stop

The <Esc> is used to terminate the current operation and return to the monitoring state. There are two main cases when <Esc> is used: to exit from a pull-down menu or entry prompt without executing anything and to terminate a CMD file.

Menu mode

If <Esc> is pressed when a menu or prompt is displayed, control is passed to the monitoring mode which redraws the spectrum display and waits for new commands.

Command File mode

The MAESTRO II can execute command files for an automatic operation of a sequence of commands (see Services, Run Cmd File and PARSE).

This key ends processing of the command file and returns control to the keyboard. If the command file is executing a "waiting for MCB to complete," then this key terminates the wait and continues in the command file. A second <Esc> terminates the command file.

If the MAESTRO II command file is started from the DOS command line and <Esc> used to end the command file processing, then the MAESTRO II goes to Interactive mode. The DOS Batch file is left pending until the MAESTRO II is exited via Services, Quit (<Alt S>, <Alt Q>, "Y" <Enter>).

COMMAND FILES

The MAESTRO II runs a series of commands that control data collection and data storage and execute other DOS programs. The details of the commands and the required syntax are given in this section. The command files can be executed by selecting Run Cmd File in the Services menu, or by including the name of the command file on the command line (e.g., C>MCA DEMO).

The command files are used for the following types of functions:

1. In the MAESTRO II, performing a repetitive task, including running a user-written program to control experiments,

2. Defining initial conditions and then continuing in the MAESTRO II,

3. In an external DOS Batch file, performing a task and then returning to Batch.

Command files written for previous version of MAESTRO can be used. They will work on new MCBs as well as older models with the exception of the new commands added in this version of MAESTRO II.

To perform a repetitive task, command files can be run from the MAESTRO II. This function is useful for performing a specific set of tasks or repeating a sequence many times without operator intervention.

In defining initial conditions, the command file can set the specific parameters for the program and then revert to Interactive mode. This is useful in preloading presets after power loss for the 916, 917 or 918 each time MAESTRO II is rerun.

For running the MAESTRO II from an external DOS Batch file, a command file with the WAIT and QUIT commands may be executed upon start up. This function is useful for viewing data when the MCA program is included in another Batch file. After execution, the MCA program exits and returns control to the Batch file which called the program.

Examples are given in the descriptions of the commands.

The classes of available commands are the following:

MCA Control
Analysis
Data Storage
Logical

MAESTRO II has the ability to run repetitive loops. The current loop count can be included in any string, including filenames, program parameters, and text. Data can thus be stored with unique filenames and labeled with unique descriptions.

If an error is encountered in running a command file, the execution of the file is stopped and control returns to the MAESTRO II. If the command file was entered from a command line (as in the DOS command: MCA INITAL.CMD), control goes back to DOS (or the Batch file) with ERRORLEVEL set to 1.

In the following descriptions, a variable filename or text is enclosed in "..." and a variable number is enclosed in <...>.

SUMMARY OF MAESTRO II COMMANDS

CLEAR	Clears the data in the active MCB segment(s).
CHANGE_SAMPLE	Controls and monitors the sample changer signals on the 92X and 919.
DESCRIBE_DETECTOR "TEXT"	Enters the text into the detector description to be saved with the spectrum.
DESCRIBE_SAMPLE "TEXT"	Enters the text into the sample description to be saved with the spectrum.
FILL_BUFFER	Transfers the data from the active MCB/Segment(s) to the Buffer.

LOOP <VALUE>...END_LOOP	Executes all the commands between LOOP and END, <VALUE> number of times.
MARK_PEAKS	Sets ROIs on all peaks in the active MCB/Segment(s).
QUIT	Returns to DOS.
RECALL "FILENAME"	Reads the spectrum in the disk filename to the Buffer.
RECALL_CALIB "FILENAME"	Loads the calibration data from the spectrum in the disk filename to the Buffer calibration parameters. The spectrum is not changed.
RECALL_ROI "FILENAME"	Sets the ROIs in the active segment(s) in the Buffer or MCB according to the table in the disk filename.
REPORT "FILENAME"	Prints the ROI-marked peak report to the disk filename or to a device (PRN or CON).
RUN "PROGRAM"	Executes any DOS .EXE or .COM program.
SAVE "FILENAME"	Saves the spectrum in the active segment(s) of the Buffer in the disk filename.
SAVE_ROI "FILENAME"	Saves the table of ROIs in the active segment(s) of the Buffer in the disk filename.
SEND_MESSAGE "TEXT"	Sends the text to the MCB.
SET_MCB <VALUE>	Selects the MCB (1 to 8) or Buffer (0).
SET_NAME_STRIP "FILENAME"	Sets the strip filename.

SET_PRESET_CLEAR	Clears all presets in active segment.
SET_PRESET_COUNT <VALUE>	Sets the ROI Count preset to <VALUE>.
SET_PRESET_INTEGRAL <VALUE>	Sets the ROI Integral preset to <VALUE>.
SET_PRESET_LIVE <VALUE>	Sets the livetime preset to <VALUE>.
SET_PRESET_REAL <VALUE>	Sets the realtime preset to <VALUE>.
SET_SEGMENT <VALUE>	Selects the active segment (1-16) or all segments (0).
SMOOTH	Smooths the spectrum in the Buffer.
START	Starts the active segment(s).
STOP	Stops the active segment(s).
STRIP <VALUE>	Strips the disk spectrum from the Buffer with <VALUE> as the strip factor.
WAIT	Waits until the active segment(s) stop counting.

WRITING MAESTRO II COMMAND FILES

The process of writing command files to perform any of these functions can be divided into the following steps:

1. Define the operations to be performed.
2. Write the list of commands.
3. Use PARSE to compile the written list into the form needed.

The compiled command file can now be used by MAESTRO II.

A common operation that is ideal for command file operation is the collection of many sample spectra without operator intervention. One example of this is the collection of a series of spectra to show the radioactive decay.

This process can be described as follows:

Set the MCB parameters such as livetime;

Start the acquisition;

Wait for the acquisition to stop;

Integrate the nuclide peak;

Record the peak area;

Repeat this for the required number of samples.

By looking at the list of commands above, and the explanations below, the necessary commands can be determined and written down.

The first step in the process is to initialize the MCB to the condition needed of 1000 seconds livetime. These are:

```
SET_MCB 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
CLEAR
```

Note that all the presets were cleared before setting the livetime preset. This is to ensure that no previous presets (left over from other users) will

interfere with this analysis. Now start the acquisition and wait for completion of the livetime.

```
START
WAIT
```

During this time the display manipulation keys are active so that the spectrum can be studied while the collection is occurring.

Now move the spectrum from the MCB to the computer Buffer. Select the Buffer for the computational step.

```
FILL_BUFFER
SET_MCB 0
```

In the next step, the nuclide peak of interest is being marked by reading in an ROI file. This ROI file has been previously defined by looking at the spectrum and marking the peak (or the region around the peak). This ROI data is saved on the disk under the name DECAYPK.ROI (<Alt R>, <Alt S>). This command file will work on different peaks or nuclides just by changing the ROI file.

```
RECALL_ROI "DECAYPK.ROI"
```

The peak areas of the marked peak or peaks is printed on the printer by this command.

```
REPORT "PRN"
```

This gives a list of the peak areas and count rates for the marked peak. If the library (LIB.MCB) has a peak near this energy then the peak identify will also be printed.

This set of instructions will only do the collection and reporting once. The commands could be repeated for as many times as needed. A more concise way is to use the LOOP command. To use this, put LOOP before CLEAR and END_LOOP after REPORT. The whole file is now:

```
SET_MCB 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
LOOP 10
CLEAR
START
WAIT
FILL_BUFFER
SET_MCB 0
RECALL_ROI "DECAYPK.ROI"
REPORT "PRN"
SET_MCB 1
END_LOOP
```

Note that an additional SET_MCB 1 has been inserted after REPORT, so that the loop will operate on the MCB.

Now using an editor such as EDLIN (any text editor used for programming can be used, but word processors generally cannot because these word processors insert special codes into the text), enter this set of commands into a file. Give the file the name SAMPDATA.TXT.

After the commands have all been entered correctly, exit the editor and use PARSE to compile the text file into the form used by MAESTRO II. This compiling checks that the commands are all valid commands and correctly used. Also, by using compiled files, MAESTRO II is able to perform the functions faster.

If PARSE does not detect any errors, an output file is written with the name SAMPDATA.CMD. This file can be executed from the Services menu of MAESTRO II.

This command file can be improved by the addition of the saving of each spectrum on the disk. This is done by inserting the SAVE command in the text file. The spectrum sample description is also entered here. This sample description is saved with the spectrum and is printed by the REPORT command. Note that the loop counter (the ??? in the text) is used in the SAVE and DESCRIBE_SAMPLE commands.

The new file is:

```
SET_MCB 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
LOOP 10
CLEAR
START
WAIT
FILL_BUFFER
SET_MCB 0
DESCRIBE_SAMPLE "This is sample ???."
SAVE "DECAY???.CHN"
RECALL_ROI "DECAYPK.ROI"
REPORT "PRN"
SET_MCB 1
END_LOOP
```

On a slow printer, the printing of the report may take some time. To overlap the data collection with the analysis, the logic of the command file needs to be modified to restart the acqusition after the data have been moved to the Buffer. All of the analysis is performed on the Buffer spectrum so the MCB spectrum can be erased and the next one started.

The modified file is:

```
SET__MCB 1
SET__PRESET__CLEAR
SET__PRESET__LIVE 1000
CLEAR
START
LOOP 10
WAIT
FILL__BUFFER
CLEAR
START
SET__MCB 0
DESCRIBE__SAMPLE "This is sample ???"
SAVE "DECAY???.CHN"
RECALL__ROI "DECAYPK.ROI"
REPORT "PRN"
SET__MCB 1
END__LOOP
```

These few examples show some of the possibilities of the command language in MAESTRO II.

CLEAR

This command clears (erases) the data, the realtime and the livetime for the selected segment(s). A segment that is collecting data is not cleared. The presets are not changed.

This command has the same function as <Alt-A>, <Alt-C> (Acquire, Clear). The command should be preceded by the SET_SEGMENT and SET_MCB commands as follows:

```
   .
   .
   .
SET_MCB 1
SET_SEGMENT 1
CLEAR
   .
   .
   .
```

CHANGE_SAMPLE

This command is used to control the "change sample" and "sample ready" ouputs on the rear panel of the 92X and 919. These control signals are intended for use in controlling sample changers. This command should be issued after the data from the current sample have been collected and before the next sample spectrum collection is started. This command works as follows: The SET_OUTPUT_HIGH command is sent to the currently selected MCB. The sample-ready status is monitored until the input is low. The SET_OUTPUT_LOW command is now sent to the currently selected MCB. The command then returns to the command file. If the input does not go low within about 300 seconds, an error is reported.

Note: If the sample chamber controls are not able to make the sample-ready signal go high before the checking (i.e., the normal state of sample ready is low; it goes high while the sample changer is moving, and goes low when the sample changes is at the new position), then it may be necessary to use the SEND_MESSAGE command to send a SET_OUTPUT_HIGH command, pause, and then send the CHANGE_SAMPLE command.

The following example demonstrates this.

```
SET_MCB 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 30
LOOP 5
CLEAR
START
WAIT
FILL_BUFFER
SEND_MESSAGE "SET_OUTPUT_HIGH"
SET_MCB 0
RECALL_ROI "MONTE.ROI"
SAVE "MONTE???.CHN"
REPORT "MONTE???.RPT"
SET_MCB 1
CHANGE_SAMPLE
END_LOOP
```

DESCRIBE_DETECTOR "TEXT"

This command accepts a 60-character description of the detector system. This description is saved with the spectrum using the SAVE command function, and is included in the REPORT printout.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear.

DESCRIBE_SAMPLE "TEXT"

This command accepts a 60-character description of the sample being analyzed. This description is saved with the spectrum using the SAVE command function, and is included in the REPORT printout. In the interactive mode (<Alt-F>, <Alt-S>), the user is asked for the sample description during the save operation.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear.

FILL_BUFFER

This command transfers the active MCB/Segment data to the Buffer. This command has the same function as MCB > Buffer in Acquire.

LOOP <VALUE> ... END_LOOP

This command pair executes multiple times all the commands between LOOP and END_LOOP. The number of execution times is specified by <VALUE>. Each command must be given on a separate line. A value of 0 executes once. A LOOP with no END_LOOP statement executes once.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear. Spaces should be included only in the text and not in the filename. Filenames with spaces cannot easily be used by DOS commands.

The following is an example:

```
SET_MCB 1
SET_PRESET_LIVE 20
LOOP 3
SET_MCB 1
CLEAR
START
WAIT
FILL_BUFFER
SET_MCB 0
SAVE "TEST???.CHN"
END_LOOP
```

The above commands run three 20-second acquisitions and store the data on a disk in TEST001.CHN, TEST002.CHN and TEST003.CHN.

MARK_PEAKS

This command does a Mariscotti-type peak search on the spectrum in the Buffer. The peak search sensitivity is selected in the Calculation menu. Each peak found is marked with a ROI. If the Buffer is calibrated, the width of the ROI is three times the calculated FWHM of the peak. If the Buffer is not calibrated, the width of the ROI equals the width of the peak as determined by the peak search function.

Overlapping or close peaks may have contiguous ROIs. Existing ROIs are not cleared.

This command has the same function as Peak Search in Calculation.

The following is an example of the MARK_PEAKS command used with REPORT:

```
.
.
.
MARK_PEAKS
REPORT "TESTDAT.RPT"
.
.
.
```

The above procedure does a peak-search-directed report of nuclides found, as listed in the library LIB.MCB.

QUIT

This command exits the MAESTRO II and returns the system to DOS.

This command has the same function as Quit in Services, except that no operator verification is required.

RECALL "FILENAME"

This command reads a disk filename to the Buffer area. The disk file was created by SAVE. Any DOS filename, including the drive and subdirectory, can be used. The resultant segmentation of the Buffer is the same segmentation of the file. The file, the livetime and the realtime are restored to the proper segment. In FULL display mode (segment 0), the unused segments are set to zero; therefore, to replace only one segment, that segment should be displayed.

Recalling a null or all-zero spectrum is an easy way to erase the Buffer.

If the spectrum file has calibration information, the calibration parameters are used to set the calibration for the Buffer.

This command has the same function as Recall in Files.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear. Spaces should be included only in the text and not in the filename. Filenames with spaces cannot easily be used by DOS commands.

RECALL_CALIB "FILENAME"

This command loads the Buffer calibration parameters from the calibration data stored with a spectrum.

If the active MCB/Segment and segmentation are the same as the Buffer MCB/Segment and Buffer segmentation, then the Buffer calibration parameters are transferred to the MCB.

This command can be used in generating reports that include library isotope identification. The following is an example:

```
.
.
.
RECALL_CALIB "CALIB001.CHN"
MARK_PEAKS
REPORT "NEWDATA.RPT"
.
.
.
```

The report NEWDATA.RPT includes isotope identification using the energy calibration contained in CALIB001.CHN.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear. Spaces should be included only in the text and not in the filename. Filenames with spaces cannot easily be used by DOS commands.

RECALL_ROI "FILENAME"

This command marks the ROI channels in the Buffer or MCB to conform to the table in the disk file, created by SAVE_ROI or Save file in ROI. The data contents of the MCB or Buffer are not altered by this operation. The previous ROIs are cleared.

If the ROI file is saved for a FULL display that is segmented, then RECALL in EXPANDED mode alters only the ROIs for the active segment.

This command has the same function as Recall file in ROI.

This command can be used in generating reports that look for specific isotopes (library-directed as opposed to peak-search-directed). The following is an example:

A calibration spectrum is run containing ^{57}Co and ^{137}Cs, and ROIs marked on the 122 keV and 662 keV peaks. The calibration is saved as spectrum file COBCS.CHN and as ROI file COBCS.ROI. The command sequence is

```
.
.
.
RECALL_CALIB "COBCS.CHN"
RECALL_ROI "COBCS.ROI"
REPORT "COBCS.RPT"
.
.
.
```

The above commands report the values only for the 122 keV and 662 keV peaks. Compare with the example for MARK_PEAKS.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear. Spaces should be included only in the text and not in the filename. Filenames with spaces cannot be easily used by DOS commands.

REPORT "FILENAME"

This command prints the sample and detector descriptions, the MCA number, realtime and livetime, the date, and segment of the Buffer.

If the spectrum is not calibrated, REPORT prints the following:

1. ROI number and segment number (1 is lowest in segment)
2. Start channel of the ROI
3. Stop channel of the ROI
4. Gross area of the peak
5. Net area for peak, as calculated in Peak area in Calculate
6. Error in net area, as calculated in Peak area in Calculate
7. Centroid channel of the peak, as calculated in Peak area in Calculate
8. FWHM
9. FW.1M

If the spectrum is calibrated, REPORT prints the following:

1.-9. All the above values in both energy and channel
10. The best match from the library

If a match is found in the library, REPORT prints the following:

11. The corrected net count rate using the net area, livetime and the factor from the library.

The output can be printed on the printer (PRN), or sent to a disk file. The disk file can be used by other programs or printed later. If CON is selected for the output, the MCA display is displaced. To return to the MCA display, press F1 and <Enter>.

This command has the same function as Report in Files.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear. Spaces should be included only in the text and not in the filename. Filenames with spaces cannot easily be used by DOS commands. If a filename with a space is created, use the DOS COPY command to change the name, substituting a question mark (?) for the space.

RUN "PROGRAM"

This command executes one DOS EXE or COM command. Redirection is not supported (see DOS manual). The program COMMAND can, however, run a daughter copy of DOS which supports the redirection, command line inputs and Batch files. To accomplish this, the operator enters COMMAND/C and the program name.

If the program executes correctly, with an ERRORLEVEL of 0, the program prints a "successful" message. Otherwise, the emulation screen remains on for a short time before the screen is redrawn with an "unsuccessful" message. If the user program does not set the DOS variable ERRORLEVEL correctly, the successful or unsuccessful message may not be properly displayed.

This command has the same function as Run Program in Services.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear. Spaces should be included only in the text and not in the filename. Filenames with spaces cannot easily be used by DOS commands.

The following (MOVESAM.BAS, overleaf) is an example of calling a BASIC program (from the Command file) to start the sample changer and wait for it to complete its motion. It relies on the sample changer starting motion on the start sample signal and for the sample changer to switch the sample ready signal from low to high when it completes.

```
TAKDAT.CMD
        .
        .
        .
        RUN "MOVESAM"
        START
        WAIT
        .
        .
        .
```

MOVESAM.BAS

```
100 DEF SEG = &HD000
110 OUT &H292,0
120 MESSAGE$="SET_OUTPUT_HIGH"
130 GOSUB 500
140 GOSUB 700
150 MESSAGE$="PAUSE_INPUT_HIGH"
160 GOSUB 500
170 WLOOP=0
180 GOSUB 700
190 IF WLOOP = 100 THEN GOTO 170
200 SYSTEM
500 REM WRITE A MESSAGE TO THE MAILBOX
510 MAIL%=&H043
520 L=LEN(MESSAGE$)
530 FOR J=1 TO L
540 C%=ASC(MID$(MESSAGE$,J,1))
550 POKE MAIL%,C%
560 MAIL%=MAIL%+4
570 NEXT
580 POKE &H03B,L
590 POKE &H03,&H0FF
600 RETURN
700 REM READ A MAILBOX MESSAGE
710 MESSAGE$=""
720 J=PEEK(&H7C3)
730 WLOOP=WLOOP+1
740 IF WLOOP > 100 THEN RETURN
750 IF J = 0 THEN GOTO 710
760 L=PEEK(&H7FB)
770 MAIL%=&H803
780 FOR J=1 TO L
790 MESSAGE$=MESSAGE$+CHR$(PEEK(MAIL%))
800 MAIL%=MAIL%+4
810 NEXT
820 POKE &H7C3,0
830 RETURN
```

SAVE "FILENAME"

This command saves file the active segment(s) of the Buffer in a disk. The disk filename can be any valid DOS filename. The default extension is .CHN. The realtime, livetime, start of acquisition, and, if available, calibration data, detector description, and sample description are stored with the spectrum. In a segmented system, each segment must be saved with a separate SAVE command and stored in a separate file.

This command has the same function as Save in Files.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear. Spaces should be included only in the text and not in the filename. Filenames with spaces cannot easily be used by DOS commands. If a filename with a space is created, use the COPY command to change the name, substituting a question mark (?) for the space.

SAVE_ROI "FILENAME"

This command saves a table of channel numbers that have the ROI set for the active MCB/Segment(s) or Buffer in a disk. The disk filename can be any valid DOS filename. The contents of the spectrum are not altered by this operation. Any number of files can be saved.

This command has the same function as Save File in ROI.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" the first time the question marks appear. Spaces should be included only in the text and not in the filename. Filenames with spaces cannot easily be used by DOS commands. If a filename with a space is created, use the COPY command to change the name, substituting a question mark (?) for the space.

SEND_MESSAGE "TEXT"

This command is used to send NIM-488 commands to the active MCB. This can be used to perform any operations of the MCB that are desired. The text must be in the syntax expected by the MCB. If the response from the MCB does not end with a command-accepted message, then this command will exit with error.

The MCB commands and syntax are described in the Hardware Operator's Guide for that unit.

No checking of the text is done either by this command or by PARSE.

The following is an example of using this command to set the fine and coarse gain to a total value of 50 (the product of the fine (= .5) and coarse (= 100) gains).

```
.
.
.
SET_MCB 1
STOP
CLEAR
SEND_MESSAGE "SET_GAIN_FINE 2048"
SEND_MESSAGE "SET_GAIN_COARSE 100"
.
.
.
```

SET_MCB <VALUE>

This command selects the active MCB or the IBM PC Buffer. The MCB number <VALUE>, can be 1 to 8 according to the MCB configuration (see M2), or 0 for the PC Buffer.

If an MCB is selected that does not exist, no change is made.

This command (values 1 to 8) has the same function as Ctrl F1 through Ctrl F8, and (value 0) as MCB/Buffer in Display.

SET_NAME_STRIP "FILENAME"

This command is the first half of the two command sequence to strip data in disk files from the spectrum in the Buffer. The other command is STRIP. This command sets the disk filename to the name given. No other action is taken by this command.

This command must be executed before STRIP.

SET__PRESET__CLEAR

This command clears the presets for the active MCB/Segment. The clearing should be done to ensure that unwanted presets are not used by the MCB when the MCB is started.

Note: For the 916, 917 and 918, the new presets (including CLEAR) can be loaded at any time, but preset settings or clearings are not put into effect until the MCB/Segment goes from STOP to START. For the 919 and 92X, the presets can only be changed when the unit is not counting.

The MCB and MCB/Segment should be selected by the SET__MCB and SET__SEGMENT commands before the SET__PRESET__CLEAR command is given.

This command has the same function as Clear All in Preset.

```
.
.
.
SET__MCB 1
SET__SEGMENT 1
STOP
SET__PRESET__CLEAR
START
.
.
.
```

SET_PRESET_COUNT <VALUE>

This command sets the ROI peak count preset for the active MCB/Segment. The preset is set to the entered value. If the system is in FULL mode, the preset is set for all segments for the active MCB.

With this preset condition, the MCB stops counting when any ROI channel's content reaches this value. If no ROIs are marked in the MCB/Segment, then that MCB/Segment never meets this condition.

The preset value for the active MCB/Segment is shown at the middle of the right side of the screen.

The preset value is entered in counts.

If used in conjunction with other preset conditions, the first condition met causes the MCB to stop.

See the note in SET_PRESET_CLEAR.

This command has the same function as ROI Peak in Preset.

SET_PRESET_INTEGRAL <VALUE>

This command sets the ROI Integral Count preset value for the active MCB/Segment. The preset is set to the entered value. If the system is in FULL mode, the preset is set for all segments for the active MCB.

With this preset condition, the MCB stops counting when the sum of all counts in all channels marked with a ROI reaches this limit. If no ROIs are marked in the MCB/Segment, then that MCB/Segment never meets this condition.

The preset value for the active MCB/Segment is shown at the middle of the right side of the screen.

The preset value is entered in counts.

If used in conjunction with other preset conditions, the first condition met causes the MCB to stop.

See the note in SET_PRESET_CLEAR.

This command has the same function as ROI Integral in Preset.

SET__PRESET__LIVE <VALUE>

This command sets the livetime preset for the active MCB/Segment. The preset is set to the entered value. If the display is in FULL mode, the preset is set for all segments for the active MCB. The livetime preset overrides the realtime preset.

With this condition, the MCB stops counting when the livetime reaches this limit. The livetime is the realtime minus the deadtime.

The preset value for the active MCB/Segment is shown in the middle of the right side of the screen.

The preset value is entered in seconds and fractions-of-a-second. The MCB clock is stored in 20-millisecond increments.

If used in conjunction with other preset conditions, the first condition met causes the MCB to stop.

See the note in SET__PRESET__CLEAR.

This command has the same function as Livetime in Preset.

SET_PRESET_REAL <VALUE>

This command sets the realtime preset for the active MCB/Segment. The preset is set to the entered value. If the display is in FULL mode, the preset is set for all segments for the active MCB. The realtime preset overrides the livetime preset.

With this preset condition, the MCB stops counting when the realtime reaches this limit.

The preset value for the active MCB/Segment is shown in the middle of the right side of the screen.

The preset value is entered in seconds and fractions-of-a-second. The MCB clock is stored in 20-millisecond increments.

If used in conjunction with other preset conditions, the first condition met causes the MCB to stop.

See the note in SET_PRESET_CLEAR.

This command has the same function as Realtime in Preset.

SET_SEGMENT <VALUE>

This command sets the segment in the MCB to the value that is entered. The value must be in the range specified in the segmentation of the selected MCB (see M2SETUP). The special case of segment 0 is used when referring to all segments (FULL mode). If the value is not in the range allowed, there is no segment change.

SMOOTH

This command will do a smooth of the data in the Buffer. It is the same as Calculate, Smooth (<Alt C>, <Alt H>), where more details are given. A five-point, area preserving, binomial smoothing algorithm is used.

The original contents of the Buffer are lost.

START

This command starts data collection in the selected MCB/Segment. If the MCB is segmented, all segments are started if the system is in FULL mode (see SET SEGMENT 0). If in EXPANDED mode, only the active segment is started.

If the MCB has already been started, no operation is done.

See the note in SET_PRESET_CLEAR.

This command has the same function as Start in Acquire.

STOP

This command stops data collection in the active MCB/Segment(s). If the MCB is segmented, all the segments are stopped if the system is in FULL mode (see SET-SEGMENT 0). If in EXPANDED mode, only the active segment is stopped. If the MCB has already been stopped, no operation occurs.

This command has the same function as Stop in Acquire.

STRIP <VALUE>

This command strips the disk spectrum specified in the SET_NAME_STRIP command from the spectrum in the Buffer and stores the results in the Buffer. The disk and Buffer spectra must be the same size. The disk spectrum can be scaled up or down by <VALUE> (a constant) or, if <VALUE> is zero, by the ratio of the livetimes of the two spectra. If the scaling constant is negative, the disk spectrum is added to the Buffer spectrum.

If the SET_NAME_STRIP command has not been executed prior to this command or there is a read error on the disk file, this command exits with an error.

```
.
.
.
SET_NAME_STRIP "DEMO.CHN"
STRIP 0
.
.
.
```

WAIT

This command causes the MAESTRO II to wait until the active MCB/Segment(s) stops counting. If only one segment is selected (SET_SEGMENT i), the WAIT ends when this segment stops. If all segments are selected (SET_SEGMENT 0), the wait ends when all segments stop. If there are no preset conditions, then the WAIT never ends.

The <Esc> key can be used to end the WAIT.

During a WAIT, only the display scaling and cursor keys are active.

This will wait on segment 2 to stop:

```
.
.
.
SET_MCB 1
SET_SEGMENT 2
WAIT
.
.
.
```

This will wait on all segments to stop:

```
.
.
.
SET_MCB 1
SET_SEGMENT 0
WAIT
.
.
.
```

SELECTED 92X COMMANDS

Included here are a few of the 92X commands that are used in the programming examples. For complete descriptions of these commands and for a list of all the commands, see the Hardware Manual for the device being used.

PAUSE_INPUT_HIGH

This command causes the 92X to wait until a high level is detected on the sample ready input or the next command is received before responding with a percent response record (e.g., %000000069). The external device must keep the sample-ready input level high until the MCB responds or it may not be detected.

PAUSE_INPUT_LOW

This command causes the 92X to wait until a low level is detected on the sample ready input or the next command is received before responding with a percent response record. The external device must keep the sample-ready input level low until the MCB responds or it may not be detected.

SET_OUTPUT_HIGH

This command sets the change sample output to a high level.

SET_OUTPUT_LOW

This command sets the change sample output to a low level.

SET_GAIN_ADJUSTMENT <VALUE>

This command sets the gain adjustment to <VALUE>.

SET_GAIN_CHANNEL <VALUE>

This command sets the center channel of the region used for the gain stabilizer peak to <VALUE>. If <VALUE> is chosen such that the beginning channel would be below channel 0 or the ending channel would be above the maximum channel (determined by the conversion gain), the gain peak width is reduced until the peak fits the device boundaries. This command cannot be attempted while gain stabilization is enabled.

SET_GAIN_COARSE <VALUE>

This command sets the amplifier coarse gain to one of the allowed values. The allowed values are:

0	Coarse gain set to default (10X)
20	Coarse gain set to 20X
40	Coarse gain set to 40X
100	Coarse gain set to 100X
200	Coarse gain set to 200X
500	Coarse gain set to 500X
1000	Coarse gain set to 1000X

SET_GAIN_CONVERSION <VALUE>

This command sets the conversion gain to one of the allowed values. The allowed values are:

0	Conversion gain set to default (16384)
512	Conversion gain set to 512 channels
1024	Conversion gain set to 1024 channels
2048	Conversion gain set to 2048 channels
4096	Conversion gain set to 4096 channels
8192	Conversion gain set to 8192 channels
16384	Conversion gain set to 16384 channels

SET_GAIN_FINE <VALUE>

This command sets the fine gain to <VALUE>.

ENABLE_HV

This command enables the high voltage output on the rear panel of the Model 92X. The voltage selected on the rear panel of the Model 92X will be present on the high voltage output within 60 seconds after this command is received unless the output is overloaded or the output is shut down by the high voltage shutdown.

DISABLE_HV

This command disables the high voltage output on the rear panel of the Model 92X. With no external load on the high voltage output, the output will remain present for approximately 60 seconds.

ENABLE_GAIN_STABILIZATION

This command enables the gain stabilization. It can only be used after the gain stabilization has been initialized.

DISABLE_ZERO_STABILIZATION

This command stops stabilization of the zero peak while data are being acquired. The zero stabilization adjustment is held at its current value until either zero stabilization is re-enabled with the ENABLE_ZERO_STABILIZATION command or reinitialized with the INITIALIZE_ZERO_ADJUSTMENT command.

DISABLE_GAIN_STABILIZATION

This command stops stabilization of the gain peak while data are being acquired. The gain stabilization adjustment is held at its current value until either gain stabilization is re-enabled with the ENABLE_GAIN_STABILIZATION command or reinitialized with the INITIALIZE_GAIN_ADJUSTMENT command.

ENABLE_ZERO_STABILIZATION

This command enables the zero stabilization. It can only be used after the zero stabilization has been initialized.

INITIALIZE_GAIN_ADJUSTMENT

This command resets the gain peak stabilization adjustment to unity (no adjustment). This value is reported as 2048 by the SHOW_GAIN_ADJUSTMENT command.

INITIALIZE_ZERO_ADJUSTMENT

This command resets the zero peak stabilization adjustment to unity (no adjustment). This value is reported as 2048 by the SHOW_ZERO_ADJUSTMENT command.

PROGRAM FILES

These programs, included with the A64-BI software, support the MCA operation. The programs are the following:

M2COLORS
M2SETUP
MAKELIB
PARSE
PLOT
GRAF350

M2COLORS selects the MAESTRO II screen colors.

M2SETUP creates the MCB configuration file for MAESTRO II.

GRAF350 does the print-screen function to a graphics printer, to make printed copies of the display.

MAKELIB converts a library text file into a .LIB file for use by the MAESTRO II.

PARSE converts the command file text into CMD files to be executed by the MAESTRO II.

PLOT plots spectra on the HP 7470A family of plotters.

M2COLORS

This program allows the operator to select the colors for the MAESTRO II display that best suit his individual needs. The color data is stored in a file (COLORS.M2) in the \MCA directory or the default directory. If this file is not found or cannot be read then the default colors are used.

Separate colors can be selected for the fields shown in Figure 102. These are spectrum background, normal spectrum, compare spectrum, ROI channels, channel marker and data, text foreground and background, menu foreground and background, title foreground and background, dialogue foreground and background. The highlighted menu item in a pull-down menu is shown in the text colors so the menu colors should not be the same as the reversed text colors. It is also possible to select colors with little or no contrast so that the foreground is not visible on the background.

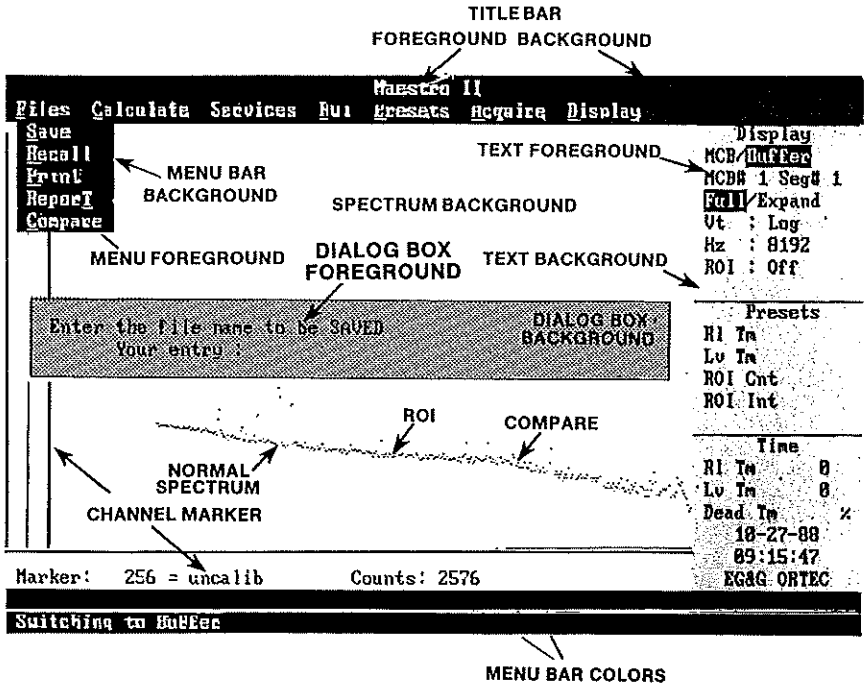


Figure 102. MAESTRO II Screen Colors

The colors are selected from a selection of 64 colors. The colors are displayed on the screen during the selection process. Figure 103 is a typical screen that is shown for each of the colors to be specified. Eight colors (0 to 7, then 8 to 15, etc.) are displayed at one time. Use <up arrow> and

<down arrow> to go from one group of eight colors to another group of eight colors. Use <left arrow> and <right arrow> to select one of the eight colors. The <Esc> will skip to the next entry without changing the selected color. The <Enter> will change the color to the selected color and advance to the next entry.

The background color is requested first. When the foreground color is requested, the box surrounding the eight color chips is in the background color for that entry so that the good color combinations can be seen.

M2COLORS may be run as many times as needed to determine the best color combinations. Several different color combinations can be defined and saved as disk files. To use a specific color combination, use the DOS COPY command to copy the desired file to COLORS.M2.

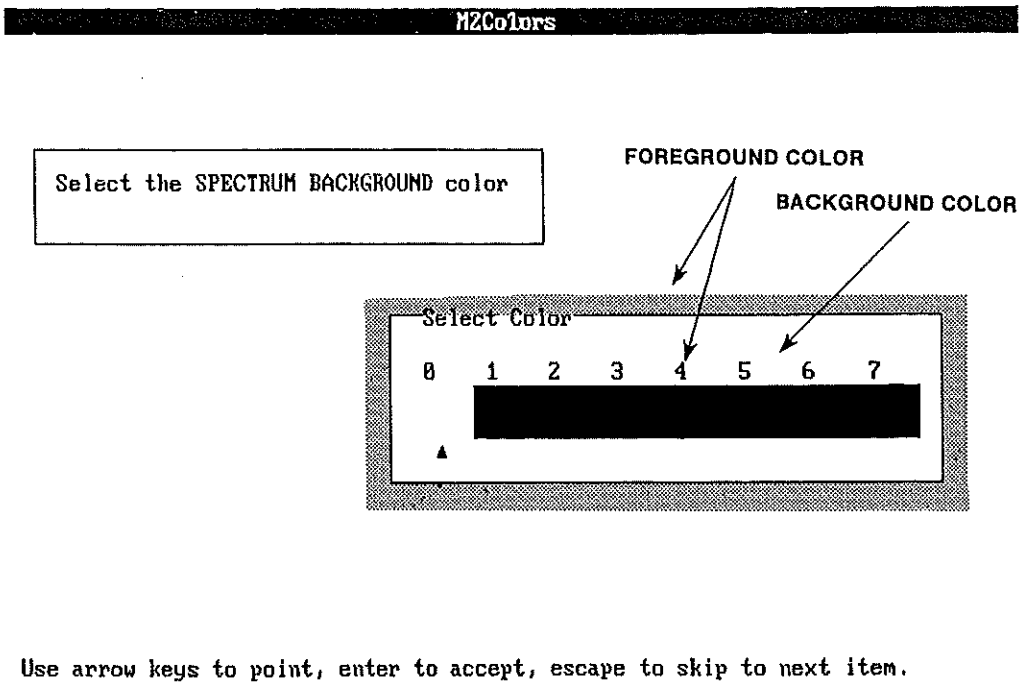


Figure 103. M2COLORS Typical Entry Screen

Note: Selecting color 0 (black) by pressing <Enter> in response to all choices will produce a solid black display. M2COLORS reads the file COLORS.M2 for its own display, so the next attempt to run M2COLORS will be unusable. If this occurs, erase \MCA\COLORS.M2 and COLORS.M2 in the current directory.

M2SETUP

This program is used to tell MAESTRO II the MCB hardware connected to the PC. The user defines the MCBs in this program and a file containing all the parameters is written to the default disk. MAESTRO II reads this file when it begins execution in order to determine the system hardware. If any of the MCBs are changed, added or removed this program should be rerun so that MAESTRO II will be able to communicate with the MCBs properly. M2SETUP does not verify that the hardware is configured as defined here.

Note: M2SETUP does not create the configuration file needed for the system reference diskette for PS/2 Microchannel computers. The MCB option diskette is supplied with the MCB Microchannel interface.

The user can select the number of MCBs, the type (913 through 92X), the number of channels used, and the segmentation (917, 918).

The definition file, CONFIG.M2, is written to the directory \MCA, if possible (i.e., the directory has been defined) or otherwise to the default directory. MAESTRO II searches for the file in the same manner. This file also contains the calibration settings for all the units; these are reset when this program is run.

The program displays the questions and the available answers for each question. Use the <up arrow> and the <down arrow> to select the desired answer (highlighted). Use <Enter> to accept the highlighted value. The program then goes to the next question.

To run the program, type

M2SETUP <Enter>

and the screen in Figure 104 will be displayed.

This program uses COLORS.M2; see note in M2COLORS if no display appears.

This configuration process is quite simple for the usual system of one MCB connected to a PC. The flexibility of the MCB approach allows many different combinations to be constructed and hence the general description of this process can be complicated.

Each 913, 916, 917, 918, and 92X can occupy one address on the MCB bus. A 919 can occupy up to four addresses on the bus. Each unit must be set

to the desired address. See the manual supplied with each intrument for instructions on how to set the address.

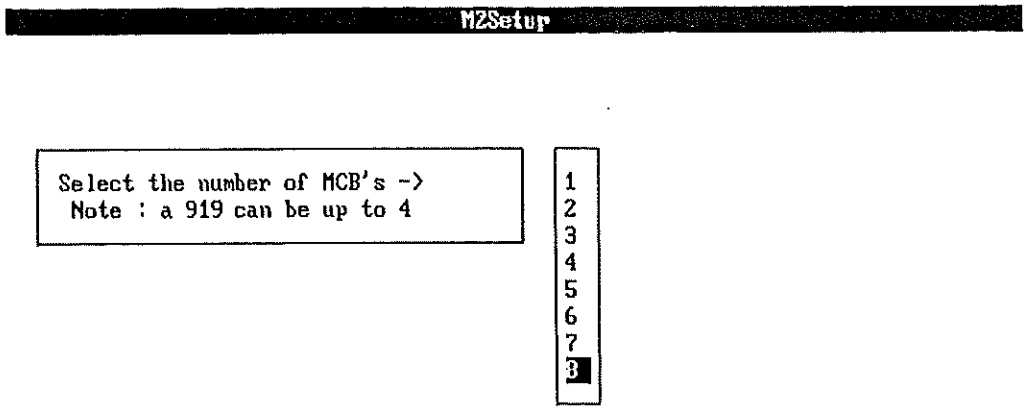


Figure 104. Set Up MAESTRO II First Screen

The 919 has an internal multiplexer for up to 4 inputs. All of the inputs do not need to be used and any unused inputs can be ignored. In the total of MCB units, count the 919 inputs as individual MCBs. The 919 inputs must be sequential (i.e., if two are used they must be 1 and 2). Any unused unit numbers may be used by other MCB units. For example, if two inputs of a 919 are used, then the next unit is number 3.

MAESTRO II does not control MCS units, but as these units occupy MCB bus addresses they must be included in the total unit count.

Select the desired number and press <Enter>. The screen in Figure 105 will be displayed for each unit.

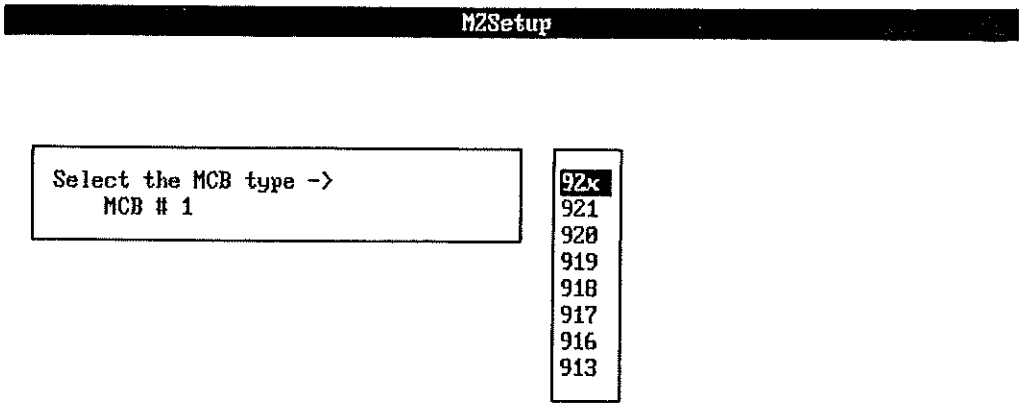


Figure 105. MCB Hardware Selection

Select the correct MCB type for the unit shown and press <Enter>.

If a 92X is selected, then the screen in Figure 106 is displayed. Select the correct answer for this 92X and press <Enter>. The transistor reset preamplifier is part of specially equipped HpGe detectors and, if included, must be connected to the 92X according to the hardware instructions.

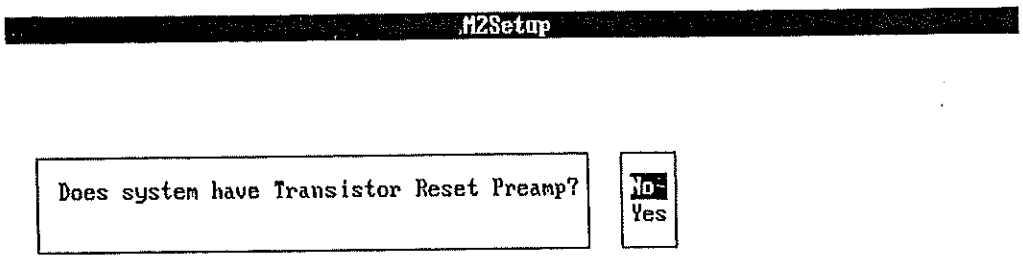


Figure 106. Select TRP

If a 919 is selected, then the screen in Figure 107 is displayed. Select the number of inputs for this 919 and press <Enter>.

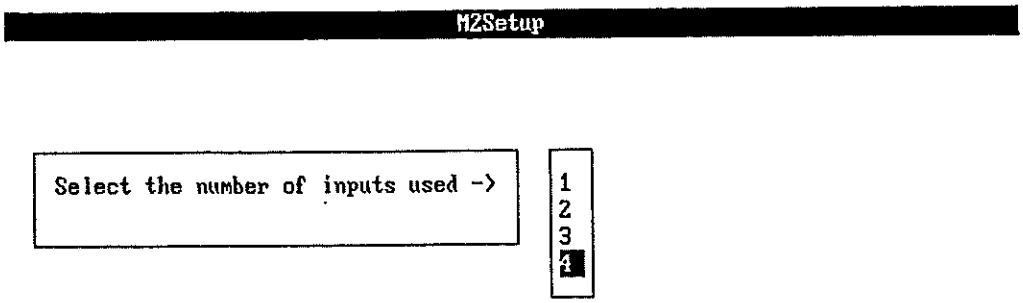


Figure 107. Number of 919 Inputs

The number of channels used for a spectrum depends on the analog-to-digital converter (ADC) used. The ADC is a device that converts a given pulse height (analog signal) to a specific number (digital representation). The ADC will accept pulses up to a maximum level (usually 10 volts) which corresponds to the maximum number output. The maximum output is called the conversion gain. An ADC can have an adjustable conversion gain meaning that the maximum input pulse can correspond to different digital outputs depending on how it is set. Thus, an ADC could have 10 volts correspond to the channel 16384 for one setup and be set to have 10 volts correspond to channel 4096 for another setup.

The memory size is requested next (see Figure 108). This is the memory used to store the spectra for this MCB. It is the number of channels in the FULL spectrum display mode. All of the MCBs can have different spectrum sizes and the display will automatically scale the horizontal width to the proper size.

The maximum memory size for the 916-2 is 2048; 916-4 and 917 is 4096; 916A-8 and 918 is 8192; and 919 and 92X is 16384. The actual entry here can be any number equal or less than these. For the 916A, 919 and 92X

this value is sent to the unit to set the conversion gain. For the 916, 917 and 918 the conversion gain is hardware-controlled. In the 917 and 918 this entry should be the conversion gain if the Mixer/Router is not used. If the Mixer/Router is used this input must agree with the hardware settings.

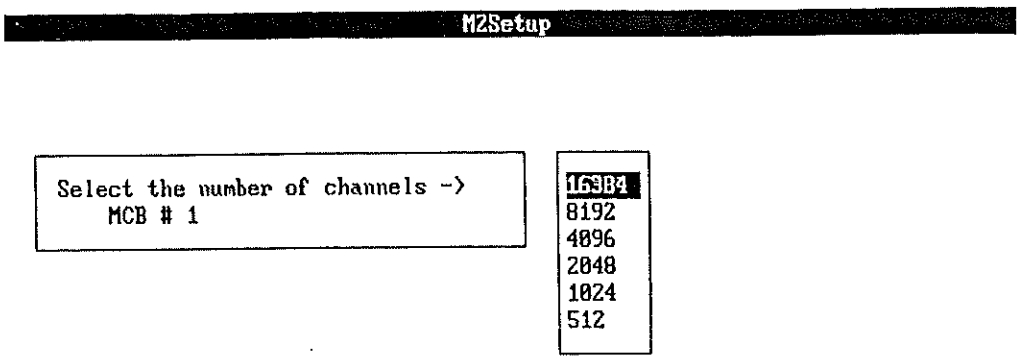


Figure 108. MCB Memory Size

Select the correct entry and press <Enter>.

The 917 and 918 support the 476 Mixer/Router. The 920 has an internal mixer. The number of inputs or segments is selected in the next screen, shown in Figure 109. Each MCB can have a different number of segments. The hardware conversion gain setting must agree with the memory size and number of segments selected.

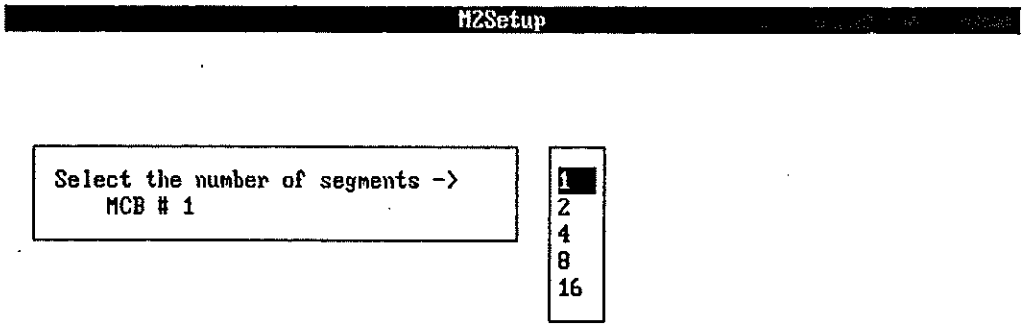


Figure 109. Number of Segments

MAKELIB

The MAKELIB program converts a library text file into the file LIB.MCB. This library file is loaded when the emulation program is first executed. The library text file format is the following:

Cols	Function
1-9	Energy of gamma ray in keV
10	Space
11-17	Isotope name
18-19	Space
20-25	Factor as a real number, including decimal; use 1.0 for no change in intensity. This factor is multiplied times the net count rate to obtain the corrected net count rate printed out on the report.

The text file can be created by any programming editor or word processing editor that does not imbed special codes in the text. The library must be ordered in ascending energy. If the input energies are entered with the decimal point in the same position for all lines, then the DOS SORT program can be used to arrange the library in energy order.

The following is an example of a TXT file created by an editor, sorted by DOS SORT and ready for input to MAKELIB:

```
  14.4100 CO-57     1.0
  22.1600 CD-109    1.0
  24.9400 CD-109    1.0
  31.8171 CS-137    1.0
  32.1936 CS-137    1.0
  36.4000 CS-137    1.0
  88.0341 CD-109    1.0
 122.0630 CO-57     1.0
 136.4760 CO-57     1.0
 255.0600 SN-113    1.0
 279.1900 HG-203    1.0
 391.6880 SN-113    1.0
 511.0000 Y-88      1.0
 661.6600 CS-137    1.0
 802.0000 CS-137    1.0
 898.0210 Y-88      1.0
1173.2370 CO-60     1.0
1332.5010 CO-60     1.0
1836.0100 Y-88      1.0
2616.0000 CO-60     1.0
```

MAKELIB asks for the name of the library text input file and writes the output to LIB.MCB. To create multiple libraries, change the output file created by MAKELIB to another name using the DOS RENAME command. MAESTRO II always uses the LIB.MCB file in the local directory. To change from library to library, exit MAESTRO II, rename the library, and rerun MAESTRO II.

MAKELIB can be run with the library text filename on the same line, as

```
MAKELIB DEMOLIB
```

or MAKELIB will ask for the inputs if no name is on the command line.

PARSE

The program PARSE converts the entered text to an executable command file. This works in much the same way that a compiler converts source input to an object output file.

The text may be entered using a programming editor such as EDLIN, or, for simple files, COPY CON (see DOS manual). The word processing editor must use pure ASCII characters. For example, WordPerfect in the DOS text output mode works fine.

The command file text has one command per line. The resulting file is then input to PARSE.

PARSE does the following:

Checks for valid commands
Checks for valid variables
Writes the text input on the screen with error messages if errors are found
Creates a CMD output file

PARSE can be executed in the following ways:

Command Line mode
Interactive mode

Command Line Mode

In Command Line mode, the entry is

PARSE Input filename (without extension)

The filename is entered without an extension as in

PARSE Infile

The output filename becomes Infile.CMD. The extension default for Infile is .TXT. If an output file exists, it is overwritten.

Interactive Mode

In Interactive mode, the entries are

Input filename (with extension)
Output filename (with extension)

If the output file exists, the user may overwrite it or may enter a new filename.

PLOT

This program plots MAESTRO II output spectrum files (.CHN) on an HP 7470A or equivalent plotter. It functions the same way as the PLOTCHN program of A18-BI. The user selects the following:

Start and stop channels for the plot
RS-232 port number for the plotter connection
6-decade logarithm mode or linear mode for plot
Scale maximum in linear mode or autoscale

In linear mode, the vertical scale (peak height) is rounded upward to the next decade (i.e., 34970 to 40000; 450 to 500).

Note: If no plotter is connected to the selected RS-232 port, the program waits. This may require rebooting the computer.

The Interactive mode is

PLOT

PLOT asks the following:

Enter input filename
PLOT asks for the filename of the MAESTRO II output file. The default extension is .CHN. The default is to exit.

Enter port number
Enter 1 for COM1, or 2 for COM2. See note above.

Enter starting channel
Enter the channel to start the plot. The default is channel 1.

Enter ending channel
Enter the last channel to be plotted. The default is the length of the data in the file.

Do you want a linear plot?
NO selects log plot; YES selects linear plot.

Enter the vertical scale maximum

Enter the value for the highest count. This is rounded upward to the next even decade. An entry of 0 selects autoscale. In autoscale, the highest count in the plotted region is used for the vertical scale.

The command line is

PLOT FILE:chnfil PORT:i FROM:j TO:k LINEAR

where

PLOT	is the name of the program file.
chnfil	is the name of the input spectrum file (.CHN). The default extension is CHN. If not found, the program exits.
i	is the port number for the plotter cable. (COM1 = 1, COM2 = 2).
j	is the start channel for the plot; the default is the start of the file.
k	is the stop channel for the plot; the default is the end of the data.
LINEAR	specifies a linear vertical scale. The default is a LOG scale.
LOG	specifies a log vertical scale. The default is a LOG scale.

The errors are

File not found

Read error on file

Input file is not MAESTRO II output type = -1

Syntax error

The command line does not have the correct syntax.

Inputs must be explicitly entered

If a keyword is entered on the command line, then the input filename must be on the command line. There is no default input file.

PLOT not made

The following are the plotter settings:

2400 Baud
8-bit word
1-stop bit
No parity
U.S. paper size

GRAF350

This program will plot the graphics mode screen displays on a graphics printer. It is a terminate and stay resident (TSR) program. It should be run before MAESTRO II. If it is to be used often, it should be put in the AUTOEXEC.BAT file, so that it will always be available. The program is operated by pressing <Print Screen> for PS/2s and <shift Prt Sc> for PCs. If the EGA or VGA display is in the MAESTRO II graphics mode the screen is plotted on the display. After the plot the computer returns to normal. If the display is not in the MAESTRO II graphics mode, control is passed to the normal screen dump routine.

This program is optimized to produce the best plot for the display for MAESTRO II and other EG&G ORTEC programs. For this reason, it may not produce the best plot for other programs' displays.

APPENDIX A

This appendix describes the file structure for the spectrum data files, the ROI data files and gives example programs that access the spectrum files.

PHA DATA FILES

The PHA integer data files contain the channel-by-channel contents of the MCB. The header is 32 bytes long and contains the following:

Byte Offset	Byte Length	Use
0	2	Must be -1
2	2	MCA number
4	2	Segment number
6	2	ASCII seconds of start time
8	4	Realtime (increments of 20 ms)
12	4	Livetime (increments of 20 ms)
16	8	Start date as ASCII DDMMMYY0, or binary zeros, if not known
24	4	Start time as ASCII HHMM, or binary zeros, if not known (see Byte 6 above)
28	2	Channel offset of data
30	2	Number of channels (length of data)

The next part of the file contains the spectrum stored as 4-byte integers. There are no record separators in the file. The number of spectrum records is determined by the number of channels in the spectrum.

The last part of the spectrum file contains additional descriptive information about the spectrum, as follows (the byte offsets are relative to the end of the spectrum):

Byte Offset	Byte Length	Use
0	2	Must be -101
2	2	Reserved
4	4	Energy calibration zero intercept, 0.0 for uncalibrated spectrum
8	4	Energy calibration slope, 1.0 for uncalibrated spectrum
12	4	Reserved
16	4	Peak shape calibration zero intercept, 1.0 for uncalibrated spectrum
20	4	Peak shape calibration slope, 1.0 for uncalibrated spectrum
24	232	Reserved
256	1	Length of detector description
257	63	Detector description
320	1	Length of sample description
321	63	Sample description
384	128	Reserved (The total length is 512 bytes.)

ROI FILES

This file is created by SAVE-ROI and contains a list of the start and stop channels for the ROIs in the display. The file contents are as follows:

Byte Offset	Byte Length	Use
0	2	Must be -2
2	2	Start channel number of first ROI
4	2	Stop channel number of first ROI
.		
.		
.		
		Continue for all ROIs in the display
n	2	Start channel = -1 is end of data

PROGRAM EXAMPLES

The following examples show how to read CHN data files and ROI region-of-interest files. These are simple program segments to illustrate the programming details needed.

FORTRAN Language

This section contains two routines; one to access the CHN files and one to access the ROI files.

CHN Files

```
C This program prints the header data from an MAESTRO II data
C and the contents of a channel.
C
      INTEGER*2 TYPE,MCA,SEG,STRTCH,LNGTDT,SPCOUI(64)
      INTEGER*2 BEGREC,ENDREC
      INTEGER*2 TLRTYP,IS
      INTEGER*4 SPCIN(32),LVETME,RLTIME
      REAL*4 ENG(2),FW(2),X1
      CHARACTER*1 SRTTME(4),SRTSEC(2),SRTDTE(8),OUTPUT(30)
C
C     START
C
      WRITE(0,100)
100   FORMAT(29X,'SPECTRUM PRINT ROUTINE',//)
C  Open the spectrum file
      OPEN(1,FILE=' ',STATUS='OLD',ACCESS='DIRECT',RECL=32)
C  Read the first 32 bytes (first record) from the file
      READ(1,REC=1) TYPE,MCA,SEG,SRTSEC,RLTIME,LVETME,
     1 SRTDTE,SRTTME,STRTCH,LNGTDT
C  Check to see if the first word is a numeric -1, if not
C       then quit
      IF(TYPE.NE.-1) GO TO 1000
C  It's good, so write out all the data from the header,
C  note that the start time is split into two parts
      WRITE(0,150) TYPE,MCA,SEG,RLTIME/50,
     1  LVETME/50,SRTTME,SRTSEC,SRTDTE,STRTCH,LNGTDT
150   FORMAT(' TYPE = ',I4,' MCA # ',I2,' SEGMENT # ',
     1  I3,/,' REALTIME = ',I10,' SECONDS, LIVETIME = ',
```

```
     2  I10,' SECONDS',/,' DATA COLLECTED AT ',2A1,':',2A1,
     3  ':',2A1,' ON ',2A1,'-',3A1,'-',3A1,/,
     4  ' STARTING CHANNEL = ',I6,' NUMBER OF CHANNELS = ',
     5  I6,//)
C  The first trailer record is after the last channel data.
C  Divide the length by 8, because there are 8 channels per
C  record.
      LREC=3+(CHNLEN-1)/8
C  Read the first trailer record.  TLRTYP is the record type
C  The variables IS and X1 are dummys maintain the position
C  in the file.
      READ(LUN,REC=LREC,ERR=100)TLRTYP,IS,ENG(1),ENG(2),
     1  X1,FW(1),FW(2)
      WRITE(0,160) ENG,FW
160   FORMAT(' ENERGY ZERO = ',E14.8,/,' ENERGY SLOPE = ',
     1 E14.8,/,' FWHM ZERO = ',E14.8,/,' FWHM SLOPE = ',E14.8)
 C  Ask the operator for the channel number to print out
      WRITE(0,200)
200   FORMAT(' Enter channel number: ',\)
C  Get the channel number
      READ(0,210) ICHNNL
210   FORMAT(I5)
C  Calculate the block of 8 channels that this one is in.
C  There are 8 channels in a record of 32 bytes.
      CHANEL=ICHNNL-1
      ENDREC=CHANEL/8.
      BEGREC=CHANEL/8.
C  This is only one record in this example, but could be any
C  number of records.  The 2 is the offset past the header
C  and the records start at 1.  So the first data record is 2.
      DO 450 I=BEGREC+2,ENDREC+2
C  Read the 8 channels
        READ(1,REC=I) (SPCIN(K),K=1,8)
C  Print the 8 channels along with the channel number of
C  the first channel
        WRITE(0,410) 1+8*(I-2),(SPCIN(K),K=1,8)
410     FORMAT(1X,I5,8I9)
450   CONTINUE
      CLOSE(1)
1000  STOP
      END
```

```
      INTEGER*2 LUNROI,LSTREC,IBEGIN,IEND
C
      WRITE(0,100)
100   FORMAT(29X,'ROI PRINT ROUTINE',//)
C  Open the ROI file
      OPEN(1,FILE=' ',STATUS='OLD',ACCESS='DIRECT',RECL=2)
C  Read the ROIs
      I=0
      IROI=1
C  Add 2 to skip past the header
200   READ(1,REC=I+2) IBEGIN
C  If the entry is 0 then this is the end of the list
      IF(IBEGIN.LE.0) GO TO 1000
C  If the beginning is there then the end is also
      READ(1,REC=I+3) IEND
C  But its one too many
      IEND=IEND-1
C  Write them all out
      WRITE(0,220) IROI,IBEGIN,IEND
220   FORMAT(' ROI # ',I3,' START ',I6,' STOP ',I6,)
C  Add 2 to I to advance past the begin and end numbers
      I=I+2
      IROI=IROI+1
C  Keep going until we run out of numbers
      GO TO 200
1000  STOP
      END
```

```
/*************************************************************************/
/*        Sample program compatible with Microsoft and Borland C         */
/*         to read header and channel data from a CHN data file          */
/*************************************************************************/

#include <stdio.h>

#define  CHN   -1

main(argc,argv)

   int   argc;

   char  *argv[];

   {
   char           acq_time[32];   /* buffer for time and date */


   int           f_type;         /* CHN file type */

   unsigned int   chan_offset,    /* beginning channel number of data */
                  count,          /* general purpose loop counter  */
            mca_num,        /* 1-4 are valid  */
                  num_chans,      /* number of data channels */
            num_writ,       /* number of bytes written out */
                  segment;        /* segment number */


   long int       livetime,       /* 20ms tics of livetime */
                  realtime,       /* 20ms tics of realtime */
                  chan_data;      /* stores channel data */
```

```
  FILE  *f_pointer;

  if (argc != 2)
     {
     printf("USAGE:readchn filename.chn\n");
     exit(1);
     }

  f_pointer = fopen(argv[1],"rb");

/*************************************************************************/
/*                            Header Data                                */
/*                  Output header info from CHN file                     */
/*************************************************************************/

/* Read filetype -1 (CHN) */

  fread(&f_type,sizeof(int),1,f_pointer);
  if (f_type != CHN)
     {
     printf("Not a valid file\n");
     exit(1);
     }
  fread(&mca_num,sizeof(int),1,f_pointer);     /* Read MCA number (1-4) */
  fread(&segment,sizeof(int),1,f_pointer);     /* Read segment number  */
  fread(acq_time+12,sizeof(char),2,f_pointer); /* Read start time seconds */
  fread(&realtime,sizeof(long),1,f_pointer);   /* Read no. of 20ms ticks */
  fread(&livetime,sizeof(long),1,f_pointer);   /* Read no. of 20ms ticks */
  fread(acq_time,sizeof(char),2,f_pointer);    /* Read start time date */
  fread(acq_time+2,sizeof(char),3,f_pointer);  /* Read start time month */
  fread(acq_time+5,sizeof(char),3,f_pointer);  /* Read start time year  */
  fread(acq_time+8,sizeof(char),2,f_pointer);  /* Read start time hour  */
  fread(acq_time+10,sizeof(char),2,f_pointer); /* Read start time minutes */
```

```
    fread(&chan_offset,sizeof(int),1,f_pointer); /* Read channel offset */
    fread(&num_chans,sizeof(int),1,f_pointer);   /* Read no of channels  */

    printf("TYPE = %4i MCA # %2i SEGMENT # %3i\n",f_type,mca_num,segment);
    printf("REALTIME = %10li SECONDS, LIVETIME = %10li SECONDS\n",
       realtime/50,livetime/50);


    printf("DATA COLLECTED AT ");
    fwrite(acq_time+8,sizeof(char),2,stdout);
    putchar(':');
    fwrite(acq_time+10,sizeof(char),2,stdout);
    putchar(':');
    fwrite(acq_time+12,sizeof(char),2,stdout);

    printf(" ON ");
    fwrite(acq_time,sizeof(char),2,stdout);
    putchar('-');
    fwrite(acq_time+2,sizeof(char),3,stdout);
    putchar('-');
    fwrite(acq_time+5,sizeof(char),2,stdout);

    printf("\nSTARTING CHANNEL = %6i, NUMBER OF CHANNELS = %6i\n\n",
       chan_offset,num_chans);

/*************************************************************************:
/*                              Channel Data                             :
/*                    Output channel data from CHN file                  :
/*************************************************************************:

    printf("CHANNEL    DATA\n");
    for (count = 0; count < num_chans; count++)
       {
       if ((count % 6 ) == 0)        /* Every 6 channels do a newline and */
          {
          printf ("\n%7i",count);    /* and print the channel number */
```

```
        }
      fread(&chan_data,sizeof(long),1,f_pointer);
      printf("%lli",chan_data);
      }

   fcloseall();

}


/*************************************************************************/
/*    Sample Program to communicate with 92X via the mailbox interface   */
/*              Compatible with Microsoft and Borland C                  */
/*************************************************************************/

#include <stdio.h>
#include <dos.h>
#include <string.h>
#include <time.h>


/* Define constants used for communication */

#define OUTFLG    0xD0000000L     /* Segment:Offset  D000:0000 */
#define TEST      0xD0000002L     /* Segment:Offset  D000:0002 */
#define OUTLENLO  0xD000001CL     /* Segment:Offset  D000:001C */
#define OUTLENHI  0xD000001EL     /* Segment:Offset  D000:001E */
#define OUTBUF    0xD0000020L     /* Segment:Offset  D000:0020 */
#define INFLG     0xD00003E0L     /* Segment:Offset  D000:03E0 */
#define INLENLO   0xD00003FCL     /* Segment:Offset  D000:03FC */
#define INLENHI   0xD00003FEL     /* Segment:Offset  D000:03FE */
#define INBUF     0xD0000400L     /* Segment:Offset  D000:0400 */

#define TRUE      '\377'
#define FALSE     '\0'
```

```
char        far  *mcb_outflg,   /* Set TRUE when command is ready */
            far  *mcb_test,     /* Written and read to see if mailbox exists *
            far  *mcb_outlenlo, /* Low byte of length of command string */
            far  *mcb_outlenhi, /* High byte of length of command string */
            far  *mcb_outbuf,   /* Buffer in 92X for commands */
            far  *mcb_inflg,    /* Set TRUE by 92X when response is ready */
            far  *mcb_inlenlo,  /* Low byte of length of response string */
            far  *mcb_inlenhi,  /* High byte of length of response string */
            far  *mcb_inbuf;    /* Buffer in 92X for responses */


main()
{
   extern int mbxio(char *, char *, char *);

   char  cmd[40],              /* command to send to 92X */
         resp[512],            /* response record, if one exists */
         per_rsp[512];         /* percent response record */

   unsigned char  mcb;         /* MCB number to talk to */

   int   comerr;               /* communication timeout error flag */

   long  start_time,           /* used to timeout if 92X does not respond */
         present_time;

/* Initialize pointers */

   mcb_outflg   = (char far *)OUTFLG;
   mcb_test     = (char far *)TEST;
   mcb_outlenlo = (char far *)OUTLENLO;
   mcb_outlenhi = (char far *)OUTLENHI;
   mcb_outbuf   = (char far *)OUTBUF;
   mcb_inflg    = (char far *)INFLG;
```

```
   mcb_inlenlo  = (char far *)INLENLO;
   mcb_inlenhi  = (char far *)INLENHI;
   mcb_inbuf    = (char far *)INBUF;

/* Get MCB to communicate with */

   printf("Which MCB?(1-8):");
   scanf("%i",&mcb);

   outp(0x292,mcb+7);    /* Data memory is MCB -1, mailbox is MCB + 7 */
   *mcb_test = '\252';       /* Write test pattern 010101010  */
   if (*mcb_test != '\252')  /* If we can't read it, mailbox isn't there */
      {
      printf("ERROR: Dual Port memory does not exist\n");
      exit(1);
      }

/* Get command to send to MCB */

   printf("\nCOMMAND>");
   scanf("%s",cmd);

/* Loop printing responses and getting commands */

   while (strcmpi(cmd,"EXIT") != 0)
      {
      comerr = mbxio(cmd,resp,per_rsp);
      if (comerr != -1)
         printf("%s\n%s\n",resp, per_rsp);
      printf("\nCOMMAND>");
      scanf("%s",cmd);
      }
}
```

```
/*************************************************************************/
/*      mbxio -- sends a command to the mailbox and gets the response    */
/*************************************************************************/

int mbxio(command,response,per_rsponse)

char  *command,              /* command to send to 92X */
      *response,             /* response from 92X, if any */
      *per_rsponse;          /* percent response from 92X */

{
   extern  char *get_resp(void);

   int    counter,           /* general loop counter */
          errflg;            /* Timeout error flag */

   long   start_time,        /* used to calculate timeout */
          present_time;

   errflg = -1;              /* init as error until we are successful */
   *mcb_outlenlo = '\0';     /* send a zero length message to sync mailbox */
   *mcb_outlenhi = '\0';
   *mcb_outflg   = TRUE;

   *mcb_inflg    = FALSE;
   time(&start_time);        /* wait for MCB to clear output flag */
   time(&present_time);
   while ( (*mcb_outflg == TRUE) && (present_time - start_time < 5))
      {
      *mcb_inflg = FALSE;
      time(&present_time);
      }
   if (present_time - start_time >= 5)
      {
      printf("MCB not responding\n");
      return(errflg);
```

```
    }

/* Put command in output buffer */

   for (counter = 0; counter < strlen(command); counter++)
      *(mcb_outbuf + (2 * counter)) = *(command + counter);

/* Write out length of command */

   *mcb_outlenlo = (char)(strlen(command) % 256);
   *mcb_outlenhi = (char)(strlen(command) / 256);

/* Set the out flag to say the command is ready */

   *mcb_outflg = TRUE;

/* Get first response record */

   strcpy(per_rsponse,get_resp());
   if (strcmpi(per_rsponse,"err") == 0)
      return(errflg);

/* See if it was a percent response */

   if (strncmp(per_rsponse,"%",1) == 0)
      {
      strnset(response,'\0',1);
      errflg = 0;                  /* good return */
      return(errflg);
      }

/* It wasn't so copy it to response and go get the percent response */
   strcpy(response,per_rsponse);
   strcpy(per_rsponse,get_resp());
   if (strcmpi(per_rsponse,"err") == 0)
      return(errflg);
```

```
   errflg = 0;                    /* good return */
   return(errflg);
}


/*****************************************************************************
/*              get_resp -- gets response from the MCB                       *
/*****************************************************************************

char * get_resp()

{

   char  resp_buf[512];

   int   counter,
         num_chars;

   long  start_time,
         present_time;

/* Wait for MCB response */

   time(&start_time);
   time(&present_time);
   while ((*mcb_inflg == FALSE) && (present_time - start_time < 5))
      time(&present_time);
   if (present_time - start_time >= 5)
      {
      printf("MCB not responding\n");
      strcpy(resp_buf,"err");
      return(resp_buf);
      }
```

```
/* Get number of characters in response and read */

   num_chars = (int)*mcb_inlenlo + 256 * (int)*mcb_inlenhi;
   memset(resp_buf,'\0',512);
   for (counter = 0; counter < num_chars; counter++)
      resp_buf[counter] = *(mcb_inbuf + (2 * counter));

/* reset input buffer flag and return response address */

   *mcb_inflg = FALSE;
   return(resp_buf);

}


/*************************************************************************/
/*         Sample program compatible with Microsoft and Borland C        */
/*     to read any portion of data memory and print it on the display    */
/*************************************************************************/

#include <stdio.h>
#include <dos.h>
#include <string.h>

#define BASEADD 0xD0000000L      /* Segment:Offset D000:0000       */
#define MASK 0x7FFFFFFFL         /* Keep all but MSB (ROI bit)     */
#define MAXCHAN 0x4000           /* Set for max number of channels */

main()
{
     unsigned long  data_val;       /* storage for channel data value */

     unsigned long  far *chan_ptr;  /* pointer to data memory */

     unsigned char  mcb;           /* MCB number */
```

```
    int       start_chan,    /* starting channel to display  */
              end_chan,      /* ending channel to display    */
              loop;          /* general purpose loop counter */

/* get MCB number to display */

     printf("MCB Number (1-8): ");
     scanf("%d",&mcb);
     outp(0x292, mcb-1);           /* Turbo C users note that outportb */
                          /* is defined as outp in dos.h      */

/* get starting channel to display */

     printf("Starting channel: ");
     scanf("%d", &start_chan);

/* get ending channel to display */

     printf("Ending channel: ");
     scanf("%d", &end_chan);

/* check validity */

   if ((end_chan > MAXCHAN) || (start_chan > end_chan))
      exit(1);

/* point to dual-port memory */

     chan_ptr = (unsigned long far *)BASEADD;

/* Print heading and start loop */

     printf("CHANNEL      DATA\n");

     for (loop = start_chan; loop <= end_chan; loop++)
```

```
    {
/* read data from pointed to channel and mask off ROI bit */
        data_val = MASK & *(chan_ptr + loop);
/* do a newline and print channel number every 5 channels */
        if ((loop - start_chan) % 5 == 0)
            printf("\n%7d",loop);
        printf(" %12lu",data_val);
    }
}
```

BASIC Language

```
5 REM  BASIC PROGRAM TO READ DATA MEMORY
8 REM    AND PRINT IT ON THE DISPLAY
10 REM
20 REM Get MCB number to display
30 REM
40 INPUT "Enter MCB Number (1-8)"; MCB
50 OUT &H292, MCB - 1
60 REM
70 REM Get number of channels to display
80 REM
90 INPUT "Number of channels"; NUMCHAN
110 REM
120 REM Point to Dual-Port Memory
130 REM
140 DEF SEG = &HD000
150 REM
160 REM Print heading and start loop
170 REM
180 PRINT "Channel     DATA";
190 FOR I = 0 TO NUMCHAN - 1
200  DATUM! = PEEK(4*I+2) + 256 * (PEEK(4*I+3) AND &H7F)
210  DATUM!=DATUM!*65536! + PEEK(4*I) + 256 * PEEK(4*I+1)
220  IF (I MOD 5=0) THEN PRINT : PRINT USING "########"; I;
230  PRINT USING "############"; DATUM!;
240 NEXT I
250 END
```

```
10 REM
20 REM  Sample Program to communicate with 92X via the
30 REM     mailbox interface.
40 REM
50 REM     Written in IBM BASIC
60 REM
70 REM
80 REM Define constants used for communication
90 REM
110         FLAGUP = &HFF
120         FLAGDOWN = 0
130         SENDFLAG = 0
140         RECVFLAG = &H3E0
150         SENDBOX = &H20
160         RECVBOX = &H400
170         SENDLEN =&H1C
180         RECVLEN = &H3FC
190 REM
200 REM Get MCB to communicate with
210 REM
220 INPUT "Which MCB?",MCB
230 INPUT">",CMD$:REM Get command to send to MCB
240 GOSUB 1000
250 IF COMERR<>-1 THEN PRINT RESP$;RSP$
270 GOTO 230
1000 REM
1020 REM Subroutine: mbxio
1030 REM
1040 REM Purpose: This routine sends a command to the mailbox
1050 REM           and gets the response.
1060 REM
1070 REM     CMD$ = command to send to 92X (eg. cmd$="START")
1080 REM     RESP$ = response record, if one exists
1090 REM     PERRSP$ = % response record
1110 REM     MCB = MCB to communicate with (1-8)
1120 REM     COMERR = -1 if communication error; 0 otherwise
1130    DEF SEG = &HD000: REM point to dual port
1140    COMERR = -1: REM assume communication not possible
1150    OUT &H292, (MCB - 1) OR 8
1160 REM
1170 REM  See if dpmem exists, write a byte, read it back
1180 REM
1190    POKE &H800, &HAA
```

```
1200     IF PEEK(&H800) <> &HAA THEN PRINT : PRINT "ERROR:
              Dual Port memory does not exist": RETURN
1220 REM
1230 REM    To synchronize the mailbox.  Send a zero length
1240 REM    command and wait for response
1250 REM
1260        POKE SENDLEN, 0: REM Low byte of length
1270        POKE SENDLEN + 2, 0: REM High byte of length
1280        POKE SENDFLAG, FLAGUP: REM Raise the Flag
1290 REM
1300 REM   Wait for MCB to clear SEND flag
1310 REM
1320        LOOP=0
1330        POKE RECVFLAG, FLAGDOWN
1340        WHILE ((PEEK(SENDFLAG)=FLAGUP) AND (LOOP <1000))
1350               POKE RECVFLAG, FLAGDOWN
1360               LOOP=LOOP+1
1370        WEND
1380        IF LOOP=1000 THEN PRINT "MCB not responding"
                       :RETURN
1390 REM
1400 REM    Put Message in the Mailbox
1410 REM
1420        FOR CNTR = 0 TO LEN(CMD$) - 1
1430        POKE SENDBOX+2*CNTR, ASC(MID$(CMD$,CNTR+1,1))
1440        NEXT CNTR
1450 REM
1460 REM    Put length of message in memory
1470 REM
1480        POKE SENDLEN, LEN(CMD$) MOD 256
1481 REM Low byte of len.
1490        POKE SENDLEN + 2, LEN(CMD$) \ 256
1491 REM High byte of len.
1500 REM
1510 REM    Raise the Flag
1520 REM
1530        POKE SENDFLAG, FLAGUP
1550 REM
1560 REM   Get 1st response record
1570 REM
1580        GOSUB 2000
1590        IF RSP$ = "err" THEN RETURN
1600 REM
```

```
1610 REM  See if 1st response was a percent response
1620 REM
1630  IF LEFT$(RSP$,1)="%" THEN RESP$ = "": PERRSP$ = RSP$:
    COMERR=0: RETURN
1640 REM
1650 REM  If 1st resp is not % response, get % response record
1660 REM
1670       RESP$ = RSP$
1680       GOSUB 2000
1690       IF RSP$ = "err" THEN RETURN
1700       PERRSP$ = RSP$
1710       COMERR = 0
1720 RETURN
2000 REM
2010 REM Subroutine: getresponse
2020 REM
2030 REM Purpose: subroutine to get a response from the MCB
2040 REM   rsp$ = response record (rsp$="err" if comm. error)
2050 REM
2060       DEF SEG = &HD000
2070 REM
2080 REM  Wait for MCB response
2090 REM
2100       LOOP=0
2110       WHILE ((PEEK(RECVFLAG)=FLAGDOWN) AND (LOOP <1000))
2120             LOOP=LOOP+1
2130       WEND
2140       IF LOOP=1000 THEN PRINT "MCB not responding":RSP$ =
   "err": RETURN
2150 REM
2160 REM  get number of characters in response and read record
2170 REM
2180       NUMCHARS = PEEK(RECVLEN) + 256 * PEEK(RECVLEN + 2)
2190       RSP$ = ""
2200       FOR CNTR = 0 TO NUMCHARS - 1
2210          RSP$ = RSP$ + CHR$(PEEK(RECVBOX + 2 * CNTR))
2220       NEXT CNTR
2230 REM
2240 REM  Reset recvflag
2260       POKE RECVFLAG, FLAGDOWN
2270       RETURN
2280 END
```

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